BUILDING CAPACITY OF THE

NMFS SCIENCE ENTERPRISE

BY

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EXECUTIVE SUMMARY

The National Marine Fisheries Service (NMFS) asked us to ascertain the scope and frequency of current program reviews, develop a proposed framework for reviews, provide a list of priorities, recommend an oversight and documentation mechanism, and review the overall science enterprise and make recommendations on the science being undertaken, reported, and transitioning into management decisions. We broadly interpret our charge as advising NMFS Senior Management on scientific institution building. We considered programs, products and management of the science enterprise.

While NMFS has numerous outstanding scientists that conduct high quality research and provide sound scientific advice, our study found many problems. The National Marine Fisheries Service faces difficult challenges making some problems inevitable. Our findings are our opinions, but there may be other perspectives that merit consideration.

Our key findings are as follows:

1. NMFS Science Centers and Headquarters operate largely as independent entities in spite of National planning and coordination efforts.
2. The parallel organizational status for Science Centers and Regional Offices is appropriate, but it requires cooperation and coordination.
3. Management information is incomplete, piecemeal and hard to use.
4. There is too much program fragmentation, and investments in innovation are too small and/or subcritical mass.
5. There is insufficient scientific experience and leadership, focus on Science Centers, and follow-through, at Headquarters.
6. There are no functional program review policies.
7. The performance of stock assessment review processes is mixed, and needs to be improved in some regions.
8. Scientific Review Groups peer review marine mammal science.
9. Quality assurance processes for scientific input to the Endangered Species Act are evolving, but they are still incomplete, inconsistent, and lack adequate transparency.
10. Quality assurance of economic and social impact assessments and habitat science is largely left to internal review by the Science Centers and to Regional Fishery Management Council Scientific and Statistical Committees.
11. All Science Centers have internal review policies for documents and publications.
12. Too much faith is placed on independent peer review and the Center for Independent Experts.
13. The Federal Advisory Committee Act impedes science quality assurance.

We have four broad recommendations concerning a National framework for future program reviews, lessons learned from previous program reviews, all aspects of

management of the Agency's science enterprise, and processes to produce scientific advice to support management. Our recommends are to:

1. Implement a National process for program reviews- We think Programs should be defined and reviewed Nationally, rather Center by Center, to:
    a. Improve or create integration.
    b. Engage and make Headquarters responsible for the process.
    c. Enhance consistency nationally and over time.
    d. Assure follow-through on program review outcomes.

    Therefore, we recommend a National program review process with the following elements:
    a. A National Program Review Panel comprised of external science leaders.
    b. Five National Programs that include all of NMFS scientific activities regardless of organizational location.
    c. Program Review Teams to conduct annual program review site visits.
    d. A Program Information Database.
    e. Program Review Staff to support the process.
2. Conduct a review of reviews- There have been numerous reviews and planning effort at the regional level and from a National perspective. They have been conducted under the auspice of NMFS, NOAA, Department of Commerce, and the National Research Council. The conclusions from all of these studies should be assembled and digested as a foundation for implementing our other recommendations.
3. Reassess the organization and management of the Agency's science enterprise and make improvements as necessary- We believe improvements are necessary with respect to:
    a. Coordination with Regional Offices (at least in some regions),
    b. Some Science Center organizations,
    c. Program integration at the National level and in some cases regionally,
    d. Management information and its transmission both ways between the field and Headquarters,
    e. Investments in innovation at or above the critical mass level,
    f. Succession planning for future scientific leaders,
    g. Headquarters capability, leadership and focus, when it comes to managing the Agency's science enterprise from a National perspective.
4. Evaluate, redesign and complete, as necessary, processes for producing scientific advice for management. We recommend the following steps:
    a. Each region should prepare a description of the processes used to quality assure MSFMCA, ESA and MMPA scientific advice.
    b. National workshops should be conducted to review this information
    c. A Headquarters lead team should prepare National guidelines for quality assurance processes for advice.
    d. Regions should redesign processes, as appropriate, based on steps b-c.

e. There should be further consultation with stakeholder before finalizing and implementing regional processes.

SECTION 1. INTRODUCTION

The National Marine Fisheries Service (NMFS) is the steward of the Nation's living marine resources and the ecosystems upon which they depend. Science plays a prominent role in the Agency's stewardship mission. Specifically, the Agency's mission statement calls for "… science-based conservation and management…" More than half of the budget of the NMFS is for science. It should be as relevant, responsive, credible and sound as it can be. Toward that end, NMFS Senior Management (SM) asked us to

1. Ascertain the scope and frequency of current programmatic reviews conducted by NMFS science,
2. Develop a proposed framework for programmatic reviews that is sensitive to the intersections among physical entities and the distribution of activities among them,
3. Provide a nominal list of priorities for laboratory and programmatic reviews and as well as a draft schedule for such reviews,
4. Recommend an oversight and documentation mechanism to track both the nature of the reviews and actions taken to address recommendations,
5. Review the overall NMFS scientific enterprise and select NMFS programs, as directed, and make recommendations on the science being undertaken, reported, and transitioning into management decisions.[1]

We interpret our charge as advising SM on quality assurance of the science enterprise. Quality assurance includes program review. However, the structure and functioning of "review" needs to be placed in the context of existing and potential management structures and the way that these lead to institution building. The following issues are prominent:

1. Management of the Science Enterprise- Is it appropriately organized, is there sufficient management information, and is leadership experience and insightful enough, to set priorities and allocate assets effectively to support the Agency's mission?
2. Effectiveness of Programs- Are they relevant, do they have a good strategic design, are they properly resources, is there effective performance monitoring?
3. Utility of Products- Are scientific results (including advice on policies and management) responsive, defensible, robust to uncertainty, and fit for purpose.

The body of this report contains our findings (Section 2) and recommendations (Section 3). Appendices 1-6 respectively contain the following:

[1] From Statement of Work, see Appendix 2.

1. A description of our methodology,
2. A statement of work prepared by NMFS,
3. Ideas, observations and other considerations that supplement our findings and recommendations,
4. A description of a National Process for Program Reviews,
5. A draft Program Review Policy prepared by the NMFS Office of Science and Technology, and
6. Reports from our site visits to the six NMFS Science Centers.

SECTION 2. FINDINGS

This section of the report contains our most important findings. While we did not review the quality of NMFS research, we know of numerous outstanding scientists that conduct high quality research and provide sound scientific advice in support of the Agency's mission. The Agency is also fortunate to have an exciting mission supported by valuable assets including laboratories and ships. However, we found many problems. We recognize that some problems are inevitable given the Agency's challenging environment characterized by complex scientific issues (i.e., understand and predicting ecosystem dynamics), intense political interest, conflicting social objectives and ideologies, and multiple sometimes competing legal mandates and requirements. The problems we identified do not necessarily apply to all organizational units. Some Science Centers are doing better than others. Of course our findings are opinions based on our review, and there are probably other perspectives that merit consideration.

Our findings are divided into two categories: Program management, and program and product quality assurance processes. Our Terms of Reference highlighted program reviews, which are part of program quality assurance. However, program reviews are only useful if program management is capable of extracting program review signals from noise (i.e., reviewers are not always right) and implementing change. The ultimate measure of program quality is the quality of the products the programs produce (scientific publications, scientific advice to support the Agency's mission). Thus, programs, products and management are inseparable when it comes to assessing and advancing the capabilities of the NMFS science enterprise.

Program Management

NMFS Science Centers report to the Director of Scientific Programs and Chief Science Advisor. The Office of Science and Technology (S&T) also reports to the Director of Scientific Programs. S&T is the Director's headquarters staff to help manage programs carried out by regional Science Centers. It manages some of its own programs and serves as points of contact for many national-level and international activities (e.g., representation of LMR science on various boards and committees). Regional Science Centers have parallel organizational status with the Regional Offices that implement the Agency's resource management programs. Both report to Senior Managers (SM) in Headquarters.

The nominal purposes of organizations and management are to

- Increase capabilities so "teams" of personnel are appropriately and efficiently focused on results
- Efficiently Transmit information from field to HQ
- Efficiently Transmit information from HQ to field

The transmission of information is important for several reasons. These relate to tactical and strategic concerns. From the tactical point of view, are programs on track? Are short-term modifications required? Are their problems in the field with program budgets or constituents that need HQ attention? From a strategic point of view, are there needs or opportunities to develop a national critical mass to deal with major research problems or issues? How can programs be coordination to span the regional responsibilities of Centers (e.g., California current)? How does national coordination make the parts greater than the whole?

We found that management of the Agency's science enterprise has some serious deficiencies. We reiterate that the topic of program reviews, and more broadly science quality assurance and the health of a science enterprise, cannot be separated from organization and management. Our findings with respect to the organization and management are given below.

1. ***NMFS Science Centers and Headquarters operate largely as independent entities in spite of National planning and coordination efforts-*** Overall we found that Senior Management (SM) is faced with major immediate choices regarding program management and its consequences for the science enterprise. Basically, we found the field and headquarters operate as largely independent entities, which impedes development of a critical mass for innovative research. At stake are opportunities to advance science by strategically designing programs from a National perspective utilizing the best and most appropriate scientific capabilities of each of the Science Centers. Such an approach will attract the resources and scientific talent (the best and the brightest) that NMFS needs. Strategically designed National programs are much more than today's efforts to coordinate regional activities.
   To change, NMFS needs more National scientific leadership, and better management, information systems and organizational structures, to plan and implement National programs. We realize that this is a difficult challenge because of the decentralized culture of NMFS, which probably reflects inherent problems of building scientific capability in Headquarters. It is difficult to attract scientists to Headquarters and there is an increasing tendency for them to be consumed by NOAA, Department, interagency and Congressional demands instead of managing the Agency's science enterprise. SM needs to find a way of making Headquarters more attractive or find a way to manage science from a National perspective from another location or multiple locations.
2. ***The parallel organizational status for Science Centers and Regional Offices is appropriate, but it requires cooperation and coordination-*** While science programs ultimately support the Agency's management mission, they should report separately to a high level in the Agency to guard against local political pressures on advice and priority setting, and so there is the potential for science programs to benefit from strong scientific leadership with a national perspective and national responsibilities. However, for the organizational structure to be successful, there needs to be good coordination and cooperation between regional Science Centers and Regional Offices.

In most, but not all regions, Center staff and Regional staff (in the two regions where we visited Regional Offices) seemed satisfied with the relationship and positive about each other. Also, there seems to be a renewed interest in formalizing operating agreements between organization entities, including Science Centers and Regional Offices. While these are positive signs, we note that Regional Boards (composed of Science Directors, Regional Administrators, and senior staffs) no longer meet or meet irregularly.

Another issue is the recent build-up of science capacity in some Regional Offices and Headquarters Offices. In the early 2000s, there was an understanding that scientific capability should be placed in Science Centers and the Office of Science and Technology, not Regional Offices and HQ management offices. However, this no longer seems to be the case. We were told about science programs in some Regional Offices and Headquarters Offices (particularly the Protected Species Office and the Chesapeake Bay Office).

Was there a conscious change in policy? If so, why? If it reflects managers being dissatisfied with the scientific support they receive from Science Centers, the Agency should decide if the problem is the policy, lack of attention to coordination and cooperation, or some other type of performance problem. There is no inherently right or wrong policy concerning scientific capacity in Regional Offices, but there are important implications in terms of efficient use of scientific resources, integration of scientific activities, transition of research to operations, manager's access to relevant scientific support, scientific leadership, and science quality assurance, including an Agency policy for review of science programs.

3. ***Management processes and organizational structures of some Science Centers need improvement-*** Some Centers have Strategic Plans and other planning documents, but some Centers do not. Presumably all Centers will have a Strategic Plan as a section of the 2010-2015 NMFS Strategic Plan, which will identify priority activities. Also, Milestones are identified in electronic annual operating plans (eAOPs). However, these planning documents only seemed to play a significant role in the management of some Centers. For other Centers, these documents fulfill a headquarters requirement, but they are not used.

   There are also several National plans that include activities of regional Science Centers (Data Acquisition Plan, Stock Assessment Improvement Plan, Social Science Improvement Plan, Habitat Improvement Plan). These plans play a valuable role in formulation and justification of Executive Branch out year budgets, but they usually lack enough detail and scientifically rigorous analyses to be the basis of scientific activities implemented by the Science Centers Scientific programs should pass muster with critical scientists.

   Most Centers have a so called Board of Directors, made up of senior managers, but some of these groups meet infrequently (e.g., once a year). Their role and effectiveness varies between Centers, and in general, it is unclear. Some Science

Directors exercise reasonable control over programs through budget decisions, but other Center Directors leave it to Laboratories and Divisions. Minimal oversight probably means lost opportunities for reprogramming and innovation.

There is relatively little evidence of recent reprogramming from low priority programs to initiate new programs or invest in the future (although the NWFSC has a noteworthy program for funding small bottom up research initiatives). In an era of tight budgets and many operational priorities (implementing legal mandates), reprogramming is almost certainly necessary to fuel innovation. Most Science Centers seem to wait for new funding from HQ. Access to these funds usually requires some cost sharing (with Center base funds), which forces some degree of reprogramming, but not necessarily from low priority areas.

Organizational structures vary between Centers for no apparent reason. In some cases, activities that support particular functions or missions are consolidate and integrated within organizational entities, whereas in other Centers they are spread among several entities. Some or most Center organizations are a legacy of the past, without apparent rationale, and they are unlikely to facilitate integration, coordination, efficient application of resources, and teams of experts at or above the level of critical mass.

We think the organizational structure of the Science Centers should take account of the continuum of activities from long-term strategic research investments to operational science in the form of management advice. Ecosystem monitoring and fisheries data collection (i.e., an observing system) is part of the continuum, supporting both research and operational science. One of the strengths of this continuum is that it allows the rapid transition of research to operations (e.g., scientists involved in preparing advice, can draw on research experiences [their own and their colleagues'] as input to advice). Also, an institution that contains research along with operational science is likely to attract higher caliber scientists than an organization that has no research activity. However, unless there is some partitioning between research activities and operational science, the pressures for more near real time advice are likely to be met at the expense of research. Our conclusion is that Center Organizations and management needs to partition budgets and activities sufficiently to maintain balance along the continuum without impeding transition from research to operations. The Science Center Accreditation Program (discussed later in this report) addressed this issue.

4. ***Management information is incomplete, piecemeal and hard to use-*** We found that the transmission of meaningful information between Science Centers and Headquarters is inadequate. This has the effect of fortifying insularity among the six Science Centers as independent science enterprises rather than being part of an integrated National whole. A negative consequence of this insularity is that the good properties of Science Center are not diffused while the bad properties are fortified. It is inefficient to build the research establishment in consonance with the budget resources allocated to research in terms of six (or more considering HQ programs)

independent units. Likewise it is difficult to develop institutional excellence and to attract top-notch personal without organization.

As far as we can determine, the Agency has four main sources of management information about the Science Centers:

a. *A national financial management system.* Budget staff in the Centers seemed generally satisfied with the system for tracking expenditures by budget tasks. This is an improvement over the situation of the early 2000s when the National system (either at the NOAA or DOC level) was considered a failure and most Centers found it necessary to maintain their own systems (so called cuff systems). However, the budget system does not relate expenditures to scientific programmatic activities by sorting budget information into user specified categories when multiple budget tasks are involved.

b. *Electronic Annual Operating System (eAOP).* This seems to be an electronic version of the hardcopy Current Year Operating Plans (CYOPs) the Agency used for decades as a source of management information. However, these documents seem to be primarily a list of milestones for performance monitoring. Many of the milestones are essentially a description of planned activities (e.g., conduct a survey), but it is unclear if they cover all of the Centers activities and how the activities relate to each other or to the budget (what they cost- obviously a critical management question). Some of the Centers seem to take eAOP milestones seriously. For them they may be challenging and the Center may use eAOP milestones to monitor performance of the Center. Other Centers probably populate eAOPs to fulfill a Headquarters requirement, with milestones that are not challenging, and therefore they say little about the true performance of the Science Center.

   We are not surprised that some Centers place little priority on eAOPs as a planning and management tool, because they perceive that only a few mid level Headquarters staff, who are assigned responsibility for the system, read or use eAOPs (mostly to fulfill the NMFS' requirement to report to NOAA and DOC). We have a similar impression since no one in Headquarters even mentioned eAOPs.

c. *Data calls-* The Centers told us about frequent short turn around (sometimes a matter of hours) calls from Headquarters for information about Center programs, budgets, contracts, travel, facilities and assets (e.g., small vessels), cooperative arrangements (e.g., with universities), etc. These data calls come from all levels in Headquarters (from the Assistant Administrator to entry level employees such as Sea Grant Fellows) to all levels in the Centers. The same request may come from multiple Headquarters staff (sometimes it is not obvious it's the same request, which makes matters worse). Centers complain that it is common for them

to not know the reason information is needed or its importance. They could be more helpful and prioritize their efforts if they knew more about the requests. In some cases, the requested information may be in other management documents (such as eAOPs) or it should be. There's rarely feedback on the information provided. There may have been a similar request sometime in the past, but there is no guarantee that the answer can be reproduced.

d. *Headquarters staff's firsthand knowledge of field programs-* Such knowledge can be invaluable, but with fewer HQ staff members having experience in the field, it is less common. It will never be sufficient to substitute for a comprehensive source of information. It is dangerous to infer too much in general about the Agency from firsthand knowledge of a specific program or region.

The frequency of data calls and the anxiety they create is evidence that the Agency needs a modern management information system (MIS). Such a system should be build on raw data of activity descriptions, personnel and budget tasks and object classes, in as much detail as exists (i.e., thus the reference to raw data). It should be a modern relational database that allows data to be extracted and reports assemble according to user specified. There should be the capability to add tags or flags to fields for classification (e.g., by program, location, legal mandate, etc) and to prorate (i.e., how much of a person's time is spend on a particular activity) data. Category assignments or prorations will usually require subjective judgments, but an MIS will at least document the judgments and make data extractions repeatable and consistent. Some Science Centers have or had management information systems along these lines. The Agency does not.

5. ***There is too much program fragmentation, and investments in innovation are too small and/or subcritical mass-*** We think the lengthy list of scientific activities we complied for each Center is an indication of fragmentation. It would be easy to sort the activities into major program categories (some Centers do), but sorting is not the same thing as integration and creating programs that are greater than the sum of the parts. There is fragmentation within Science Centers, and between Centers, Centers and Regional Offices, and the field and Headquarters. There are several factors that lead to program fragmentation, small investments in innovation, and subcritical mass programs:
    a. Center organizations that do not facilitate building integrated programs. This issue is discussed above.
    b. Regionalization and a culture of doing everything in every region. Having regional Science Centers makes sense to investigate regional scale ecosystems and to serve the regional management of fisheries mandated by the MSFMCA. However, this does not mean that every type of scientific activity needs to be conducted by every Science Center. In some Centers,

program fragmentation is at the laboratory level (e.g., multiple laboratories with seemly independent stock assessment or habitat research projects). There are some examples of one Center taking the lead for multiple regions, but there are more opportunities to integrate programs on a coast wide basis or nationally to gain efficiency and create programs that are large enough to be at or above critical mass. Also, there are probably too many laboratories and Centers, although we realize that this largely reflects political interests.

c. A plethora of relatively small, independently funded programs (FATE, Aquaculture, Cooperative Research, Observers, Socioeconomics, Advance Technology, Ocean Acidification, etc, each with costly program managers trying to leverage their money) operated by Headquarters Offices. While these programs are usually competitive, there is a tendency to spread the money around to be fair. The amount of funding is usually small (subcritical mass) requiring Centers to redirect some of their base funds to the project. In fact, the goal of most of the managers of these programs is to use their funds to leverage Center funds. This results in sometimes inexperience usually mid level Headquarters staff subverting Center priorities and management. These programs may have a high overhead (e.g., cost of program managers) and high transaction costs (for proposal preparation and reviews for relatively small amounts of funding). Funds from these programs are often used to accrete sometimes stale research rather than reprogramming to develop real proof of concept ideas that could generate large amount of new money.

   Another implication of these Headquarters run programs is that they place HQ Offices in competition with the field instead of being honest brokers oversee the entire science enterprise.

d. Infrequent program terminations and/or reprogramming. We understand that terminating programs, closing laboratories, and reprogramming are difficult and unpleasant, but probably necessary to invest in innovation and to maintain or build programs above the critical mass level.
e. Lack of timely recognition of opportunities for innovation. Not all investments in innovation are good investments. To make wise investments in innovation there need to be visionary scientific leaders and processes to build a consensus among scientists at all stage of their careers on priorities for investments in innovation. Leadership is discussed below. We are not aware of processes that truly tap the innovative juices of the science community (although there are a few local examples), and if they do exist, it is not clear how they can influence budgets. Program reviews could help to identify innovation opportunities.

6. ***<u>There is insufficient scientific experience and leadership, focus on Science Centers, and follow-through at Headquarters-</u>*** We remember a period not too long ago when many of the high level positions in Headquarters were filled by people with scientific experience (in laboratories, on ships, analyzing data, building computer models) and recognition (at the National and international level). They were leaders throughout the Agency, not only in positions with scientific responsibilities. There were also experienced scientists (people who conducted and published research, who had been on the frontline dealing with Fishery Management Councils and stakeholders) in mid level positions in Headquarters. The Science Center Director positions were widely considered as the most coveted and prestigious positions for fishery scientists nationwide.
   We feel that there has been decrease in the number of experienced scientists in Headquarters and in scientific leadership overall. There are many reasons the situation has changed. People are less mobile in general (because of two career families), Headquarters is not an attractive place for scientists and it is too often a dead end. Ironically, the apparent success of the Sea Grant Fellows Program exacerbates the problem. Over the last decade or two, the Agency has placed a large number of Sea Grant fellows in permanent positions (mostly in Headquarters), and several of them have advanced rapidly (e.g., to SES positions). Undoubtedly, they are excellent employees, smart and hard working, with an understanding of (or tolerance for) life "inside the Beltway," but they usually lack hands on research experience and stature as scientists. The recent departure of the current Director of Scientific Programs and Chief Science Advisor makes the problem of too little experienced scientific leadership in Headquarters markedly worse.
   This problem has ramifications with respect to:
   a. Understanding of the scientific activities that occur in the field,
   b. Credibility with field scientists, academics, NOAA Science Advisory Board, and many prestigious NOAA scientists that represent other Line Offices in NOAA level meetings,
   c. Vision, balanced with experience, to identify wise investments in innovations,
   d. Attracting the best and the brightest young scientists to the Agency,
   e. The science based roots of the Agency and science as the foundation for policy and management (e.g., an effective science conscience in HQ).

   Another problem with Headquarters' leadership and management of the Agency's science enterprise is that the Headquarters focus seems to be on NOAA, DOC, Executive Branch Interagency Processes, and Congress. The focus is understandable because these higher level government processes are very demanding. They are also necessary for the Agency to be competitive in the Executive Branch Budget formulation process. In fact, because of the attention paid to these processes, including attention by some of the Agency's most

experienced and credible scientific leaders, NMFS has been successful as evidenced by budget increases, including large investments in infrastructure such as ships and laboratories. Unfortunately, with limited scientific capability in Headquarters, this upward focus (in the sense of organizational hierarchy) has left little time and energy to lead and manage the Agency's science enterprise. While we respect the NOAA leadership's desire over the last decade to have "all one NOAA," it comes with a cost.

One Headquarters effort that focused on building and maintaining the capability of the Agency's science enterprise was the development of a Science Center Accreditation Program during the early 2000s. The program addressed all aspects of scientific institution building (e.g., staffing including promotions and session, facilities, training, libraries, product quality assurance). It considered the balance between data collection and observing systems, strategic research investments (i.e., innovation), and operational activities such as performing stock assessments and advising on management.

We requested documentation for the Science Center Accreditation Program, but none was provided. However, the Agency once thought it was important enough to highlight it in 2002 testimony to the US Oceans Commission, as follows:

> "NOAA Fisheries is developing an accreditation program for its five fishery science centers and the collection of laboratories of which they are comprised. NOAA Fisheries recently adopted draft standards for the accreditation program and the fishery science centers are drafting implementation plans for approval later this year. The standards were developed by the NOAA Fisheries Science Board with the aid of a poll of the entire scientific, technical and administrative complements of the five NOAA Fisheries fishery science centers. The draft accreditation plan contemplates a five-year implementation period followed by external visiting committee assessments similar to that which is done in most academic scientific institutions."

We understand that implementation of the program began in about 2005-2006, but it was quickly dropped. During more than one of our Science Center visits, we heard complaints about Headquarters' failure to use or give feedback on the data (on the distribution of staff time spent on various activity categories) they had submitted.

It is likely that many of the issues raised in this report would have been addressed by the Science Center Accreditation Program, including a program review policy. There are other examples of Headquarters lack of follow through on decisions or plans to address issues raised in this report. We already mentioned that there was policy consideration about the distribution of scientific activities between Centers and Regions, the field and Headquarters, and S&T and other HQ Offices. However, those considerations seem to have been forgotten.

A more explicit example of the lack of follow though is the development of a modern Management Information System (MIS) along the lines described above. This involved a team of employees from throughout the Agency working over many months with professional facilitation. A comprehensive plan was developed and agreed by the Agency leadership during the late 1990s. As far as we can tell, only the eAOP has materialized, which falls far short of the MIS that was envisioned and is need, in our opinion.

There are probably many other examples of lack of follow-through. In the field, follow-through on the program reviews that have been conducted is mixed. In some cases, documents have been prepared giving responses to review recommendations, whereas in another cases, we were told that nothing has happen since a review that took place years ago.

Program Reviews and Product Quality Assurance

7. ***There are no functional program review policies-*** None of the Centers are functioning under a program review policy. A variety of program reviews have been conducted in the last decade, but most of the science enterprise has not been reviewed. In general, the program reviews that have been conducted appear have been well done, but the evidence that program review findings and recommendations were applied is mixed. At the current rate that reviews are being conducted, many programs will go un-reviewed for too long (a decade or longer).
8. ***The performance of stock assessment review processes is mixed, and needs to be improved in some regions-*** Each of the Centers has a stock assessment review process that is coordinated with or overseen by Regional Fishery Management Councils (RFMCs) and in some cases with Interstate Fisheries Commissions. To be successful, the processes need to have:
    a. The capable to produce assessments at the rate (number per year) required by fishery managers.
    b. A track record of giving advice that stands the test of time. That is:
        i. errors are minimal,
        ii. advice is consistent from one assessment to the next, and when it isn't, changes reflect real changes in stocks, not changes in methods, data or assumptions,
        iii. assessments have predictive value
    c. Credible with managers and stakeholders.

The processes that support the Pacific Fisheries Management Council and the North Pacific Fisheries Management Council seem to be performing reasonably well. The East Coast processes that support four RFMCs and two Interstate Commissions are struggling, at best, with respect to the frequency of assessments,

consistency of advice over time, and credibility. The process in the Western Pacific Region is new, but early experience has been problematic.

There are several factors that might explain the difference in performance between regions, such as:

a. Data quality
b. Number of scientists available to conduct assessments
c. Capability of stock assessment scientists
d. Difficulty of assessments. That is, some stocks are harder to assess than others because of life history characteristics, migratory processes, interactions with other species, or the complexity of fisheries.
e. RFMCs and Interstate Commission's expectations about the frequency of assessments
f. The culture of scientists, managers and stakeholders. That is, do they have a culture of respect and finding solutions or distrust and finding problems?

We have not critically evaluated the performance of the regional stock assessment processes in terms of factors a-f, but our impression is that an important factor behind the difference between the East and West coasts is the culture of scientists, managers, and stakeholders (factor f). We do not think that factor c explains the difference as all of the Science Centers have highly qualified stock assessment scientists. Arguably, factors a, b, and d are more challenging in the SEFSC than elsewhere, but factor e is more challenging on the West Coast (where assessments are conducted annually or every other year).

Some stock assessments are reviewed by the scientific committees of international fishery arrangements, such as the International Commission for Conservation of Atlantic Tuna (ICCAT) and International Scientific Committee (ISC) for Pacific tunas. These review processes seem to be satisfactory.

9. ***Scientific Review Groups peer review marine mammal science-*** SRGs are established under the authority of the Marine Mammal Protection Act. They are made up on non-Federal scientists. NMFS marine mammal science, such as population assessments and estimates of Potential Biological Removals (PBRs), are routinely reviewed by SRGs. NMFS marine mammal research is also reviewed by the US Marine Mammal Commission and international commissions (primarily the International Whaling Commission).
The Science Centers seemed to feel that the review of scientific products on marine mammals is satisfactory, although some concern was expressed by one of the Science Center. It occurs to us that the degree of independence of SRGs could be an issue. The marine mammal science community is relatively small. The community also depends on NMFS for research permits and in some cases funding (usually pass-through). We can envision situation which could have either a

positive and negative influence on SRG member's disposition toward NMFS. However, we have no evidence of problems.

10. ***Quality assurance processes for scientific input to Endangered Species Act are evolving, but they are still incomplete, inconsistent, and lack adequate transparency-*** The ESA requires science information on listing determinations (i.e., on a petition to list a species as threatened or endangered), status reviews, biological opinions (i.e., on the impact of a proposed action on a listed species), distinct population segments and evolutionary significant units (i.e., population units that are candidates for ESA protection), designation of critical habitat and on mitigation measures. Various processes exist to provide the required scientific information for ESA, such as Biological Review Teams, Take Reduction Teams, and a Sea Turtle Expert Group on the East Coast. However, these processes have the following weaknesses:
    a. *They appear to be ad hoc and inconsistent*. There seems to be an emerging understanding that Biological Review Teams (or some equivalent structure) will be used to provide transparent (i.e., separable from policy or management decisions) scientific input into listing determinations. We were told that the NMFS Science Board is advocating this approach, but the Agency and the Office of Protected Resources have not fully agreed. NMFS scientists participate in other groups that compile scientific information in support of the ESA (e.g., Take Reduction Teams), but it is unclear if these groups are primarily performing a scientific or managerial function. Some, presumably science based decisions, are made by Protected Species programs (in Regional Offices and/or the Headquarters Office of Protected Species), apparently with little or no scientific input from Science Centers. Some types of decisions are so frequent or minor (e.g., many biological opinions) that input from the Science Centers on all decisions would be burdensome and impractical. However, there should be a consistent protocol for determining when the decisions merit input from Science Centers.
    b. *Lack of transparent and separable scientific input to many decisions.* While the Biological Review Teams mention above provide a record of the scientific input to listing determinations, and some Centers have other processes to document scientific input, this is not so for some other ESA decisions. For example, we could not locate an Alaska Fisheries Science Center document, or some other form of transparent scientific input, to the current status review of Steller Sea Lion distinct population segments off Alaska. None is cited in the Federal Register notice soliciting scientific input to the decision. Of course there are numerous reports on the Center's Steller Sea Lion research, including documents on population trends, but these are not the same as scientific advice tailor to scientific questions

(usually in the form of Terms of Reference, ToR) that should be answered to inform decisions.

c. *Lack of operational criteria for making ESA decisions.* One of the reasons it is difficult to have transparent and separable scientific input to ESA decisions (b above) is the lack of operational criteria (analogous to overfishing definitions). It is noteworthy that this problem was recognized in the mid 2000s. Candidate protocols and criteria were formulated by a working group of Agency scientists and managers (NOAA 2004. Technical Memorandum NMFS-F/SPO-67, http://spo.nmfs.noaa.gov/tm/tm67.pdf). However, we understand that the working group's proposals were not adopted. We do not know if the proposals were deemed unsatisfactory (in which case, they might have been improved), the Agency decided it would rather not have criteria because they would be constraining, or there were other reasons.

d. *Limited scientific input from non-federal scientists.* Non-federal scientists do not serve on some of the groups involved in providing scientific input to the ESA because the groups are not exempt from the Federal Advisory Committees Act (FACA) and they are not approved under FACA. This is more of an impediment to non-Federal scientific input to ESA than it is to fisheries management because the Magnuson Stevens Fishery Conservation and Management Act (MSFCMA) is FACA exempt.

11. ***Quality assurance of economic and social impact assessments and habitat science is largely left to internal review by the Science Centers and to Regional Fishery Management Council Scientific and Statistical Committees-*** This scientific information is also considered by RFMC plan development teams in some regions, but these teams primarily design management rather quality assuring scientific information. We do not know if the quality assurance provide by Science Centers and SSCs is sufficient. However, as this information gains importance in decision processes (as it should) and impacts stakeholders, it will be subjected to more scrutiny, and it may be necessarily to put in place processes analogous to the processes used to produce stock assessment advice for fisheries management.

12. ***All Science Centers have internal review policies for documents and publications-*** All Centers have an internal review policy for publications, and it is being applied. All of the Centers were satisfied with the processes they have in place. They were able to produce records of published papers and other documents that had been through the process. We did not attempt to assess the performance of these processes or the quality of documents and publications.

13. ***Too much faith is place on independent peer review and the Center for Independent Experts[2]-*** At least one Science Center director referred to them as the "Holly Grail." We are concerned about this notion.

    There are three common forms of peer review. Sequential peer review (typically used by journals) has peers review scientific work, but the scientists that initially prepared the work retain ownership and responsibility. Integrated peer review engages independent scientists with Agency scientists to collectively agree on the final scientific product and advice, thus sharing ownership and responsibility. Independent scientific advice is a variation of integrated peer review where the independent peers have ownership of advice because they have sole responsibility for approving it. The Agency is increasingly using processes that produce independent scientific advice. We think it is a mistake.

    We have several concerns about the Agency's use of peer review and the CIE:

    a. Independent advice undercuts "carrot" and "stick" motives of Agency scientists involved in preparation of scientific advice. The carrot is recognition for their role in producing the advice (even without authorship) and the stick is accountability for mistakes. We are not suggesting that scientists should be punished for honest mistakes, but a sense of ownership and responsibility should be a greater incentive to do a good job than when responsibility is invisible.
    b. Science Centers, in particular Science Center Directors, are ultimately responsible for the scientific advice in support of the Agency's mission. Independent advice undercuts, obscures and/or confuses this responsibility. There are examples of Science Center directors disagreeing with independent advice, but not knowing how to deal with. We hope it is not that they do not feeling responsible for it. With processes that involve senior level Agency scientists in approval of advice, the Science Center Director maintains a degree of control, which is necessary to fulfill the Center's ultimately responsibility. It may be easier to surrender this responsibility to independent peer reviewers, but we think the collective capability of the scientists of a Science Center lead by an experienced Science Center Director is a better bet.
    c. Excessive dependence on independent peer reviewers leads to instabilities and inconsistencies in advice from year to year. The independent

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[2] The Center for Independent Experts was established by NMFS (under a service contract) to provide a source of experts that are free from conflicts of interest. It is also a mechanism to compensate (i.e., pay) experts for their services. Experts are selected solely by the CIE without NMFS influence. The CIE is useful to increase the credibility of a process by assuring stakeholders that NMFS did not pick experts because the Agency believes they will give favorable reviews.

see http://www.ciereviews.org/index.php

scientists that the Agency uses as peer reviewers are excellent, but they usually lack local knowledge of data, stocks, fishery management context, and the basis for past advice. An integrated process allows local (mostly Agency) scientists to compensate for the lack of local knowledge of independent experts. However, when local scientists feel like servants of independent reviewers, instead of partners, valuable local knowledge is less available or under-valued in the formulation of advice.

d. Use of CIE members for independent peer reviewers is sometimes viewed as necessary for advice to be credible. This is probably true in some circumstances, but the credibility of advice is probably more dependent on the performance of the process in the long term.
e. The rationale for the CIE is that it provides an "arms length" mechanism for selecting independent peer reviewers (i.e., the Agency cannot be accused of selecting peer reviewers they expect to be favorable). It also provides a convenient mechanism for compensating disciplines in such high demand that consulting fees are the norm (e.g., stock assessment experts). However, we think the CIE is being commonly used when arms length selection of experts and consulting fees are not necessary. Our guess is the CIE is over used by the Science Centers because they want to get their share of a Headquarters pre-paid service, which is not an efficient use of funds. Overuse of the CIE also creates multiple classes of peer reviewers (those that are paid, and those that are not), tends to unnecessarily exclude US scientists that could make a valuable contribution, and it may undermine volunteer peer review.
f. Apparently, the contract that establishes the CIE calls for CIE participants in workshops to file their own reports separate from workshop reports they approve. These reports sometimes have technical information that Agency scientists find useful, but they under cut or confuse consensus workshop reports. We have been told that these individual reports are required because of FACA and/or to maintain a record of an independent review.

It is interesting that while there seems to be a push for more independence of peer reviewers involved in the preparation of fisheries advice and for independent advice, the processes used by the Alaska Fisheries Science Center and the North Pacific Fishery Management Council have less independence than any other. Yet they are generally viewed as performing well with more buy in from managers and stakeholders than elsewhere.

14. ***The Federal Advisory Committee Act impedes Science Quality Assurance-*** We understand the positive reasons for FACA, but we doubt that Congress intended to prevent NMFS from using scientific peer review and consensus building processes in an objective and transparent manner to advise on research programs and to

produce the best science advice practicable. It is also our perception that the Agency's response to FACA varies between regions and circumstances. Legal advice on FACA probably guards the Agency against violations without full understanding of the balance between legal risks and costs of playing it safe.

SECTION 3. RECOMMENDATIONS

We have four broad recommendations. Our first recommendation is for a National framework for program reviews. Our second recommendation is for a review of reviews to maximize the benefit from past reviews (as well as this review) of the science enterprise. Our third recommendation concerns all aspects the management of the Agency's science enterprise. Our fourth recommendation addresses the processes used to produce scientific advice to support management. The recommendations are interdependent (e.g., the benefiting from program reviews depends on management capability), and all of the recommendations are important to build the capacity of the NMFS scientific enterprise.

1. ***Implement a National process for program reviews-*** NMFS drafted a framework for program reviews (Appendix 5). It is a typical approach leaving the specifics to regional Science Centers. They are to identify major programs and nominate one or two per year for review with an aim at a three to five year cycle for reviewing all programs. The only connection between reviews in each Center is that a Center Director from another Center or the Director of Scientific Programs will be a member of each program review panel.

   We think more needs to be done to:

   a. Improve or create integrated National programs with due consideration of above critical mass investments in innovation,
   b. Engage and make Headquarters responsible for the process,
   c. Enhance consistency Nationally and over time,
   d. Assure follow-through on program review outcomes.

   Therefore, we recommend a National program review process with the following elements:

   a. A National Program Review Panel comprised of external science leaders.
   b. Five National Programs that include all of NMFS scientific activities regardless of organization location.
   c. Program Review Teams to conduct site visits as part of Annual Program Reviews.
   d. A Program Information Database.
   e. Program Review Staff to support the process.

   A National Program Review Panel and National Programs will ensure that reviews consider program areas from a National perspective. The membership of Program Review Teams should have overlap across the country and over time to enhance consistency. The number of programs should be defined so that all programs are covered on a five year cycle by Annual Program Reviews. A Program Review Database that is complete, consistent, and user friendly, will also improve

consistency and integration. It will document outcomes and follow-through. Staff will be necessary to support the process.

The process described above is for systematic rotating reviews of all Agency programs. We also expect that there will be a need for smaller "one off" reviews of particular topics (e.g., such as a national review of cooperative research). Such reviews could also be guided by the National Program Review Panel, although they should be separate from the multi-year cycle of reviews. There may be a need for one off reviews within regions. These should be left to Science Centers.

A process for National Program Reviews is described in more detail in Appendix 4. This process will be demanding in terms of the internal workload and costs, and the needed for participation of experienced independent scientific leaders. However, the demands are primarily driven by the size and complexity of the NMFS science enterprise and the expectation that it will be reviewed at a reasonable frequency (i.e., every five years). The demands may be less apparent if it is left to individual Centers to run program reviews, but the total workload and cost is likely to be similar if the reviews are undertaken as frequently and comprehensively as in our proposal.

2. ***Conduct a review of reviews-*** Although the Agency lacks an functional program review policy, dozens of reviews have been conducted during the last decade as indicated in our site visit reports (Appendix 6). Furthermore, our study is not the first one to consider the NMFS science enterprise from a National perspective. There have been studies conducted under the auspices of the Office of the NOAA Chief Scientist, NOAA Science Advisory Board, Office of the Inspector General, National Research Council, and other organizations. There are also many National planning documents on specific topics including a Congressionally mandated National research plan.
   We think it would be useful to assemble and digest all of these documents so that common messages can be identified. What's been the response to recommendations? What more should be done in response to these reviews and plans? A review of reviews should be the foundation for implementation of our other recommendations.

3. ***Reassess the organization and management of the Agency's science enterprise and make improvements as necessary-*** We believe improvements are necessary with respect to:
   a. Coordination with Regional Offices (at least in some regions),
   b. Some Science Center organizations,
   c. Program integration at the National level and in some cases regionally,
   d. Management information and its transmission both ways between the field and Headquarters,

e. Investments in innovation at or above the critical mass level,
f. Succession planning for future scientific leaders,
g. Headquarters capability, leadership and focus, when it comes to managing the Agency's science enterprise from a National perspective.

We recommend a phased process with internal and external phases. We suggest that the internal phase of about six to nine months. The external phase should be planned while the internal phase is underway. If the internal phase is done well (producing concise, well conceived plans), the external phase should take no more about six months, and it should be possible for the Agency to complete the entire process (e.g., adopt plans) within eighteen months.

Internal Phase- Headquarters and Science Centers should evaluate management and propose improvements. This phase should build on the review of reviews (Recommendation 2).

Are Center organizations conducive to program efficiency and integration? Do Centers have appropriate planning and management strategies with meaningful performance measures? Do they have sufficient internal management processes and coordination mechanisms with Regional Offices? What are they doing about succession planning?

At the National level, Headquarters should reassess management information. Is there enough of it? Is it being transmitted effectively? Is it being used, and if not, why not?

Headquarters should also assess its own capability to lead and manage the Science Centers. Does it have enough experienced scientists? Does it have scientific leaders with experience, vision and stature? It should consider needs to respond to demand upward (e.g., NOAA and DOC) and to manage the Centers. How can the workload be partitioned between upward demands and Center management so that neither one gets short changed? This assessment needs to be made from both a short and long-term perspective.

The internal phase should identify programmatic activities that would benefit from coast-wide or National integration and consolidation. A policy and processes for selecting and managing investments in innovation should be prepared. The implications of the numerous small programs managed out of Headquarters offices should be assessed.

Succession planning, including mobility of personnel, should also be reviewed. Ideally, leaders in HQ should have extensive field experience and vice versa.

Many of the activities in the Internal Phase are Headquarters responsibilities, but there should be input from the Science Centers.

All of the Centers should review their organizations and management procedures, but we think some of them have more problems than others. Proposals for change, or lack thereof, should be judged on merit, not a sense of "sharing the pain" equally among all the Centers.

External Phase- This phase should be conducted by an external panel including experienced managers of mission oriented government science programs. They should review the results of the internal phase. They should have the opportunity to meet with scientific staff, scientific leaders, managers that use scientific products, and stakeholders.

The purpose of the External Phase is to "peer review" the Internal Phase. Was it done well? Does the Panel endorse or advise against the plans and recommendations from the Internal Phase? Does the Panel have additional recommendations for follow-up?

4. ***Evaluate, redesign and completion, as necessary, processes for producing scientific advice for management-*** Our findings raise several issues about the processes used to assure the quality of scientific advice. These issues include performance of some stock assessment review processes, a potential issue with marine mammal Scientific Review Groups, lack of agreement on a complete set of processes in support of the Endangered Species Act, the nature of reviews of economics and social sciences, and habitat products, the Center for Independent Experts.

   We recommend the following steps:

   a. Each region should prepare a description of the processes used to quality assure MSFMCA, ESA and MMPA scientific advice, including economics and social sciences, and habitat information.

   b. National workshops should be conducted to review this information. The workshops should include scientists, managers, and stakeholders. The workshops should compare notes on what works and what doesn't work. They should also consider if additional process, more consistency and/or more transparency, is needed for subject matter with less well developed processes than is typical of stock assessments.
   c. A Headquarters lead team (which will have to draw heavily on the field given the experience level in HQ) should prepare National guidelines for quality assurance processes for advice. The guidelines should seek completeness, consistency and transparency. With respect to consistency,

it should not be pushed so hard that regional differences are not taken into account, but there should be a logical basis for differences. At present, it is difficult to judge which differences are justified, and which ones are a legacy or a result of inertia.

The role of the CIE should also be reassessed. Undoubtedly, there are cases where it has a valuable role (one of us recalls specific examples), but it should not be overused.

d. Regions should redesign processes, as appropriate, based on steps b-c.
e. There should be further consultation with stakeholder before finalizing and implementing regional processes.

We presume a lot of documentation of processes for quality assurance of advice was prepared and approved as part of the implementation of the Agency's response to the Data Quality Act. We have not seen these documents. They may fulfill part of the need. There was probably National involvement, also partially fulfilling the need. However, we suspect that these processes were more a bureaucratic response to a legal mandate than a National process of sharing experiences, stakeholder consultations, and guidance, to achieve consistency where it is feasible and useful to improve advice.

As part of the evaluation of processes for providing scientific advice, we recommend that the Agency give high level attention to the implications of FACA and how to balance legal risks against benefits of engaging stakeholders and external experts in processes to formulate scientific advice. Our observation is that the way FACA is dealt with today ranges from ignoring it to totally excluding non-Federal participants. Neither extreme is desirable. In between, non-federal employees are sometimes required to submit separate reports even though the goal is consensus advice. In other cases, the MSFCMA exemption is presumably to apply, but we do not know how broadly this exemption actually applies, what's required for the exemption to be applied, and if the requirements are being met. In other cases, activities are presumed to occur under the auspice of FACA approved Committees (e.g., NOAA Science Advisory Board or Marine Fisheries Advisory Committee). Again, it is not clear how broadly these Committees can delegate, under what conditions, what is required. The Agency should also consider if it should be more willing to apply for FACA approval, or if it should pursue legal exemptions (such as with MSFCMA). We realize this is not a new topic, but it needs to be address in order to conduct program reviews.

Confusion or lack of understanding about FACA might be exemplified by our status. Are we advising as contract employees (in one case), under the auspices of the NOAA SAB, some other authority, or is FACA being ignored?

APPENDIX 1: METHODOLGY

We visited the NMFS Headquarters (Silver Spring) to meet with the Assistant Administrator, Deputy Assistant Administrator, Director of Scientific Programs and Chief Science Advisor, and senior managers (Director or Deputy Director) of HQ Program Offices (Sustainable Fisheries, Protected Species, and Habitat Conservation). They provided a current perspective on the importance the Agency puts on scientific information to fulfill the Agency's mission. We did not meet with the Director or Deputy Director of the Office of Science and Technology because they were away.

We also participated in a conference call with the NMFS Research Council (comprised of the Director of Scientific Programs and Chief Science Advisory, Director of the Office of Science and Technology, and six Science Center Directors) to discuss the study. During the call, it was agreed that we should visit each of the Science Centers to be briefed on the organization and programs of each Center, learn about their approach to program reviews and science quality assurance, and brainstorm with senior staff on scientific institution building. While in Seattle and Honolulu, we took the opportunity to visit two NMFS Regional Offices. The site visits were as follows:

1. NMFS Headquarters- 6-7 April
2. Alaska Fisheries Science Center- 12-13 April
3. Northwest Fisheries Science Center- 14-15 April
4. Northwest Regional Office- 16 April
5. Pacific Islands Fisheries Science Center- 17 August
6. Pacific Islands Regional Office- 18 August
7. Western Pacific Fishery Management Council- 18 August
8. Southwest Fisheries Science Center- 19 August
9. Southeast Fisheries Science Center- 2 November
10. Northeast Fisheries Science Center- 10 November
11. NMFS Headquarters- 15 December

We reviewed documents about the Agency's mandates, mission and strategy, and about the organization, activities and performance of each of the Science Centers. Documents were made available to us on a password protected website. Each of the Science Centers was requested to provide the following documentation:

1. Center Organizational Chart
2. Personnel Descriptive Stats (# of Feds, # of Contractors, # of Post Docs)
3. Center Budget (Total, By Division, By "Major" Program)
4. Publication Stats (# of publications by year/link to Publication Division)
5. Link to past Center/Programmatic Reviews
6. Link to any Center Strategic Plans

Additional documents were provided at the discretion of the Science Centers or in response to our requests. A complete set of documents can be found at: https://www.st.nmfs.noaa.gov/confluence/display/sprp/Home [3]

Our report contains descriptions of Center scientific activities (in Appendix 6). These descriptions are "cut and pasted" (with some editing and a little re-ordering) from documentation created by the Centers. They are largely the way the Center's describe themselves in terms of scientific activities. The degree of integration and coherence (or lack thereof) in these lists of scientific activities might be a signal in itself about program design.

In addition to the information we gathered during this study, our report is based on more than 75 years of relevant experience as researchers and research leaders.

[3]A password must be obtained from NMFS.

APPENDIX 2: STATEMENT OF WORK FOR MICHAEL SISSENWINE

[Brian Rothshchild donated his services]

NOAA/NATIONAL MARINE FISHERIES SERVICE (NMFS)

Office of Science and Technology (S&T)

I. Statement of Work

Under this task order, the Contractor shall provide professional consulting services to meet the following objectives:

1. Ascertain the scope and frequency of current programmatic reviews conducted by NOAA Fisheries Service science

2. Develop a proposed framework for programmatic reviews that is sensitive to the intersections among physical entities and the distribution of activities among them

3. Provide a nominal list of priorities for laboratory and programmatic reviews and as well as a draft schedule for such reviews

4. Recommend an oversight and documentation mechanism to track both the nature of the reviews and actions taken to address recommendations

5. Review the overall NMFS scientific enterprise and select NMFS programs, as directed, and make recommendations on the science being undertaken, reported, and transitioning into management decisions

Additionally, the focus of these laboratory and programmatic reviews will be considered, including adequacy of physical, financial and staffing resources to meet mission requirements, as well as the scientific stature and productivity of laboratories and work units using appropriate mission-oriented metrics of productivity.

II. Background

On November 2, 2009, a memorandum from the NOAA Senior Science Advisor to the NOAA Research Council Chair requested that NOAA establish consistent, agency-wide peer review and monitoring processes for all NOAA scientific activities. This included corporate guidance for standardizing and institutionalizing peer review procedures for all laboratories, science centers, and major research programs across the agency. To address this need, the NOAA Fisheries Service seeks to review how and when its Science Centers undergo programmatic reviews, the nature of the reviews, and how to understand and improve, if necessary, the science conducted as well as the reporting of the results.

The NOAA Administrator regularly emphasizes NOAA's role as a science-based agency to a wide variety of audiences (e.g., Administration, Congress, academia, regulated and user

communities, and the general public). The importance of high quality science is fundamental to the agency. There is a continuing need to ensure that NMFS is "doing the right science right" and whether the scientific findings are translated into management decisions. Because of this, there is a constant need for an external expert to review NMFS science as a whole and to make recommendations, as needed, which ensures the relevancy and quality of that science.

III. Description of Work and Services

The contractor shall consider recommendations in the current NMFS "Science Quality Assurance Plan" and "Draft Proposal to Establish a Systematic Process for Peer Review of Select Intramural Science Programs at the Science Centers of the NOAA Fisheries Service" and recommend changes as appropriate. Working in concert with the Director of Scientific Programs and Chief Science Advisor, the NOAA Chief Scientist (acting) and others as nominated by NOAA Fisheries Service leadership, the contractor will conduct site visits and interview Center and S&T leadership to understand the scope and scale of current procedures. She/he will collate documentation on laboratories, Divisions and Branches, and provide a matrix of their intersection. Working with Center and NMFS leadership, she/he will develop a set of criteria for how frequently individual work groups will be reviewed, the procedures for reviews (including NOAA Fisheries Service personnel and external participants), and criteria for triggering program reviews outside of the recommended schedule.

Place of Performance: No office space will be provided as it is anticipated that she/he will work from their home institution/office and provide all information electronically. A teleconference call will be set up with the NMFS Science Board at the mid-point of the contract (e.g., approximately three months after the beginning of the contract) to discuss initial results, procedures, problems encountered, suggestions for remaining reviews, and the like.

Period of Performance: From issuance of the contract through six months.

IV. Minimum experience or background requirements of Contractor personnel

- Ph.D. in a biological science or field relevant to the research conducted by NMFS
- 20+ years of relevant work experience including senior level program management in a research environment.
- Possess considerable expertise in understanding the research and activities conducted by the six NMFS science centers and the relationship of the NMFS scientific enterprise both within and outside NOAA.

V. Deliverables

All deliverables shall be provided directly to Dr. Steve Murawski or his designee via email with hard copy to follow via US mail or hand delivery.

1. A progress report at the conclusion of each science center site visit. Schedule of these deliverables are to be negotiated within 15 business days of award to allow for the scheduling and logistics of the required travel.

2. A final report including a summary and analysis of the current programmatic review policies and practices of the six science centers. This report shall also include recommendations for improvement and standardization including frequency, oversight, documentation, and action taken on recommendations given during reviews, etc. The final report shall be delivered within 6 months of the award of the task order.

VI. Schedule and Payments

This is a *firm, fixed-price*, non-personal service task order. Invoicing shall be monthly at a fixed rate for work conducted and with actual travel costs being reimbursed.

VII. Non-Personal Service Contract Statement

Contractor employees performing services under this order will be controlled, directed and supervised at all times by the Contractor's Project Manager or personnel designed by the Contractor. Contractor employees will perform independent of and without the supervision of any Government official. Actions of contractor employees may not be interpreted or implemented in any manner that results in any contractor employee creating or modifying Federal policy, obligating the appropriated funds of the U.S. Government, overseeing the work of Federal employees, providing direct personal services to any Federal employee or otherwise violating the prohibitions set forth in Parts 7.5 and 37.1 of the Federal Acquisition Regulation. The Government will perform the inspection and acceptance of the completed work.

APPENDIX 3: SCIENCE QUALITY ASSURANCE AND INSTITUTION BUILDING: IDEAS, OBSERVATIONS AND OTHER CONSIDERATIONS

This Appendix reflects our thoughts during site visits and pondering what we heard shortly afterward. A lot of the information is extracted from our notes. The most important ideas and observations are reflected in the body of our report. However, it was not practical to fully develop all the ideas in the report. We emphasize that these ideas and observations are not formal findings or recommendations, and they may suffer from an incomplete understanding of situations. Nevertheless, this Appendix may be interesting food for thought.

1. National level program management and planning processes (like PPBES and probably whatever replaces it) are intended to integrate programs across the Agency. However, these efforts have not been successful. They may not fulfill their intent of leading to integration because there is not enough investment in management information systems and staffing. Not enough time is allowed to properly design the systems or for the transition from existing systems to National level systems. Nevertheless, a lot of energy is invested selling the systems and creating plans. These plans are not useful to actually implement an integrated program at the level where data is collected, models created, and products are applied because they tend to be budget plans, not rigorous scientific designs. Existing program planning and management processes at the regional level are hard to maintain because energy is drained by needs of the National level processes, and because the incentive for regional systems is diminished when they are overshadowed by National processes. The end result is fragmentation rather than integration.
2. There should be Program Reviews at national level on a 5 year cycle with overlap in reviewers over years and regions. For example, a single chair for all reviews within years, and all annual chairs carry on in the review process as a steering committee for the full 5 year cycle (i.e., a scientists as steering committee for 5 years with each member chairing one year).
3. Before the 1970s, NMFS was primarily a research organization. After 1976 NMFS, took on the task of managing the Nation's fisheries. It seems important to consider two major types of scientific activities- one that relates to management support, and the other that relates to research. In addition to a providing fishery management services, there should be research programs that deal with ocean ecology, fishery management theory, and climate change.
4. There needs to be planning documents that are based on substantive scientific analyses. These should back-up HQ Planning Documents that are aimed at budget formulation, but not sufficient for scientific program implementation.
5. Some activities need to be strong and visible in all Centers. Other activities might be conducted by a single Center or one Center on each coast (sea turtles, highly migratory species, marine mammals on the east coast; salmon, groundfish, marine

mammals on the west coast; National centers of excellence for certain technology developments, etc).

6. There need to be processes for quality assurance of scientific products that advise management, including:
    a. Stock assessments. There seems to be a need to re-tool east coast systems and lessons might be learned from the west coast.
    b. Analogous systems for economics and social sciences.
    c. Analogous processes for habitat.
    d. Biological Review Teams and other processes for ESA. There should be a clear and separable record of science input to ESA.
7. External reviewers (CIE or whomever) and SSCs, do not alleviate the responsibility of the Centers to provide the most defensible scientific information and advice into to management that can be provided. If shared processes (SARCs, SEDARs, STARs, Biological Review Teams) get it wrong, or do not deliver, Science Center Directors need to be ready and able to step up with workable solutions. This does not mean unilateral action to trump a peer review. It means working with the entities concerned to get things on track.
8. The Agency needs to develop a consistent way of dealing with the requirements of FACA at the national level. At present, it is dealt with on a case by cases basis, and there are inconsistencies. FACA impedes beneficial peer review. . There must be a better way to fulfill FACA objectives (achieve the benefits) without undermining efforts to quality assure science (an objective everyone agrees with, FACA was not intended to undermine it).
9. An overarching concern is about the culture of politics from "within the beltway" relative to the health of the scientific enterprise. We fear that National level management has fallen victim to intense pressures, resulting in:
    e. A sense that the first priority is to reflect well on the Administration (be it Democratic, Republic or Tea Party) or not to offend the Congress, rather than to fulfill the mission by managing programs "on the ground." Ultimately this translates into a culture that the field is there to help the HQ satisfy demands that trickle down from within the Beltway, instead of the HQ being there to enable the field,
    f. The reactionary/crisis management nature of Headquarters that has gotten worse with continuous real time exchange of pseudo information (where information content may be disguised by buzz words) and the continuous news cycle,
    g. Transaction costs of being "all one NOAA,"
    h. Disagreement between the Congress and the Administration, Line Offices and NOAA, and NOAA and DOC, over budget priorities, thus undermining integrated budget planning,

i. Administrative procedures (e.g., new hiring procedures) and restrictions (limit on the number of people that can attend meetings) that are impediments to building excellent scientific institutions.

We understand the important role that the HQ plays (and of course high levels of the Executive Branch and Congress as well). Many of the people in HQ do an incredible job insulating the field from inside the Beltway pressures, and they do the best they can to generate resources to fund programs on the ground. There were times in the past where the field was unresponsive to HQ information requests and attempts to manage the Agency, which hurt the Agency and its ability to defend its budget. No one should question the need for the field to support the information needs of HQ and to adhere to rules that come from HQ. We also understand that the political nature of the inside the Beltway environment is beyond the Agency's control. However, we believe the Agency could do a better job managing its resources if it addressed some key issues discussed in our report.

10. We are concerned about the apparent inability to attract people with substantial field experience, especially in science (both both as researchers and leading research; in the past, some of the Agency's best and brightest), to leadership positions (not only science positions) in NMFS HQ. This situation seems to have gotten worse.
11. A prerequisite to manage large complex institutions is information about programmatic activities, budgets and personnel. This information exists in the Agency, but it is not in a form that is effective for program management. There is a execution system that seems to be satisfactory, but it is not linked to programmatic activities. There are an annual operating plans, personnel lists and program descriptions. The Science Centers find the eAOP useful for internal planning, but there is little evidence it is used by HQ except to track relatively performance measures, which do not necessarily reflect the most important, challenging or costly activities. When we were in HQ, no one even mentioned annual operating plans. The Science Centers feel that frequent data calls could sometimes be answered by using Operating Plans they have submitted if HQ staff were familiar with the reports, or if they were searchable. There is also a program data base associated with NOAA planning activities (PPBES process), but it seems to be separate from other program management databases.

    What's needed is a modern management information system (MIS) of disaggregated budget information, personnel, and activity descriptions in a relational database that can be searched, manipulated and used to prepare custom reports. Some Centers have, or did have, MIS, and they have been created in HQs for specific projects (e.g., for a NOAA science review in the mid 1990s). NMFS also designed an MIS during the agency "reinvention" process during the mid 1990s, but apparently it was never implemented.
12. All of the Centers receive funds from a large number of different sources usually from HQs. Examples are aquaculture funds, FATE, Cooperative Research, Advance

Technology, etc. In most cases the amount of funding is relatively small, but it leverages a lot of Center activity (which is the intention of HQ program managers). This distorts the overall Center management, and it is not conducive to integrate strategies and coordination across the Agency. The transaction costs of managing many small program budgets are problematic. Our overall assessment is that the strategic design of NMFS Centers and their management suffers from a degree of incoherence and instability in the way priorities are set at the National level and the way funds are allocated.

The idea of leveraging, which is good from the perspective of each of the small programs that buy more than they can afford, means that no one controls all of the resources needed to implement a program, and no one is fully accountable for success or failure. A related problem is that HQ offices have duel responsibilities of overseeing field programs and operating their own programs. This creates an inherent conflict of interest in the allocation of funds. The trend toward more and more HQ run programs using "their funds" to leverage field funds and influence their program direction seems to reflect a systemic problem of the HQ not feeling that the field follows their lead otherwise. It also reflects the lack of transparent, easily accessible, understandable budget and program information.

13. The Centers received a large number of requests for information from Headquarters (so called "data calls"). These requests are sometimes redundant to information in operating plans (eAOPs) that have been submitted to HQ. The Centers sometimes receive multiple requests for the same information. Often they do not know how information will be used or how important it is. This makes it difficult to know how to respond. Deadlines are sometimes ridicules. Deadlines may be beyond the control of the requestor, but sometimes requestors put off making the request until the last minute because they were swamped with more immediate crises.
14. What's the role of the NOAA Science Advisory Board? It does not seem to deal with substantive scientific issue relevant to the mission of NMFS. How could a board of a dozen or so people be sufficiently knowledgeable about all of NOAA science to address technical issues? Could the Ecology subcommittee do more? Or should NMFS have a separate external advisory process?
15. There are lots of administrative burdens drowning staff- eAOP, Personnel Performance System (Deputies as pay pool managers are especially burdened), computer security, … Someone should look at the benefit/cost ratio of all of this requirements and rules.
16. Should there be a senior scientists council of NMFS people and externals to be free thinkers, big thinkers, look over the horizon, decide on high risk research?
17. The reality is, most of what's being done is necessary and will continue without much change. Much of program management is about managing innovation and terminations to allow for innovation. One shouldn't waste too much management energy on aspects of programs that are more or less on autopilot (and rightfully

so). However, little energy seems to be aimed at terminations and reinvestment in true innovation.

18. There needs to be more formal, transparent, and quality assurance processes for scientific input to ESA decisions, analogous to scientific input to fishery management decisions. The processes in place for ESA Salmon in the Northwest region might serve as a National model, but even there, the processes are incomplete.
19. Continuing tension over roles and responsibilities for protected species is a problem. Science investments need to be based on objective judgments of the Agency's best scientist on what's need to assess status and trends of protected species, population structures, population viability, threats, and mitigation or recover strategies. To the extent practicable, management decision should be tied to quantitative criteria (PBR is one positive example, but criteria are especially needed for ESA listing decisions and Biops). There should be a transparent record of scientific input to decisions that is separable from legal and management considerations. The Centers advocate such a framework for protected species science, but it has not been agreed by the Agency. The HQ Protected Species Office and some field offices conduct some protected species science. Without a transparent and separable scientific record (as there is for fisheries management), there is a risk of confusion.
20. There were a variety of reviews cited at both Centers. They talked about internal reviews, program teams, the Scientific and Steering Committees of the Councils, and the Center for Independent Experts. However none of the Center have a formal process that is actually operating.
21. It is important to recognize that the review process needs to go beyond assessing scientific quality; it also has to determine whether goals are being met and whether the right strategic questions are being asked.
22. PPBES is a common sense approach, but is the NOAA approach to PPBES being applied consistent with its intent? We are not familiar enough with the current application to diagnose the problem, but no one seems satisfied with it. It seems to have been more of a distraction than an effective program management tool. It is being replaced by a new system, but will it be any better? Not unless it is well designed and managed, properly resources, and there is a realistic schedule to transition to the new system.
23. The Centers are pretty much locked into what they are doing. In the sense that resources are not increasing, and in real terms they even may be decreasing, all they can do is keep the program on track. This kind of situation requires management to focus on termination in order to generate new resources for new innovative programs. This is the only way to be innovative. It is not clear Centers have thought about termination management.
24. From our discussion, we do not have a sense of the focus of the program reviews that are being done. Are they focused on just outcomes, or are they focused on

whether the right strategic questions are being asked, are they focused on whether appropriate resources are targeted on the outcome? All are important, but we are concerned that there is a drift to external reviews considers only on outcomes rather than whether the research is appropriate and appropriately managed.

25. Budget codes don't match with the programs. As a result, the focus of program performance is hard to link to budgets.
26. The use of the Center for Independent Experts (CIE) is an issue. It is expensive. Is it being overuse or inappropriately used? It was only intended for use when arms length selection of external scientists is necessary for credibility of the process. This certainly isn't the case for reviews conducted by the AFSC, and it probably is not necessary in a lot of other cases. Is it displacing the role of the Agency's own bright stars, as well as other US scientists that are under-represented in the CIE (because of very strict conflict of interest rules)? Does over-use of the CIE for independent scientific advice conflict with the Science Centers' ultimate responsibility for providing scientific support for the Agency's mission? Are the individual reports filed by CIE participants in review panels or groups (STAR, SARC) counterproductive to consensus building?
27. Food for thought about strategic direction. Ocean acidification has come to the forefront as a research priority. However, the Agency does not have a coherent predator-prey program. The predatory-prey issues are central to issues raised at all of the Centers. A candidate program would be to study the ecosystem dynamics of pelagic fisheries from Baja, California to Alaska. Much of this is being done but is not being looked at in a coherent fashion? Who makes these strategic decisions?
28. Should there be a North American ICES/PICES to serve an institution building function?
29. Part of the institution building is to enable scientists to go to more meetings. Current administrative rules are a frustrating impediment.
30. The Science Center Accreditation Program was discussed as an institution building measure. What happen to it? It would have covered the requirement for a program review protocol.
31. Are sabbaticals for scientists a good investment in institution rebuilding? The existing Agency leadership development program does not seem to be working for the Science Centers. It seems to be designed to invest in future managers. What about investing in future "star" scientists?
32. We talked about publications and that these might be expected in the research mode, but not in an operation mode (routine science advice such as stock assessments). Measures of productivity are needed for both research and operational modes.
33. What about program management at the supra Center level? Where should it reside? It does not appear this can be done adequately in Washington because there are not enough experienced scientific leaders. Does there need to be a layer

for research management in Washington, or can the Centers be more effective? Could the NMFS Science Board take a higher degree responsibility for National management for science, or are they too much in a mode of "looking out for their own?"

34. Some big questions:
    a. Is NMFS asking the right science questions?
    b. Does it know the right science questions?
    c. Does it have the right science leaders to know the right questions?
    d. Is there enough big thinking and science leadership?
35. It should be noted that all NMFS science underwent an external review under the auspice of the NOAA Chief Scientist and the NMFS Senior Scientist in the mid 1990s. The focus was on laboratory closures, which is different from the focus of this study. Nevertheless, some of the information might be relevant, but we could not obtain a copy of the reports or any information on follow-up.
36. FACA is a serious impediment to external program reviews and peer review. There are work arounds (use the SAB or MSA exemption), but they are not always applicable. Individual reports by reviewers are not a good solutions.
37. What is the status of SSCs and MMPA SRGs in the determination of best available science? Is it up to the Executive Branch to make this determination, or has the law effectively given this authority to these non-governmental bodies? This is an important question in the set up of product quality assurance. It may also have legal implications. We recall when the NMFS representative on Fishery Management Councils was instructed to never join a unanimous vote because this would bind the Secretary of Commerce, which was potentially unconstitutional (pardon our lack of legal sophistication). Does a similar dilemma arise if SSC recommendations of an ABC are considered binding?
38. Some regions have a formal protocol for ESA status reviews as scientific input to listing decisions (e.g., Northwest, Southwest and Pacific Islands regions). Such a protocol was developed in the NW region during the early days of Pacific salmon listings (early 1990s), and other regions have adopted similar protocols. A 2004 agency working group made recommendations for quantitative criteria and for a review process for listing decisions (NOAA Technical Memorandum NMFS-F/SPO-67, http://spo.nmfs.noaa.gov/tm/tm67.pdf). However, the Agency has not yet put in place criteria or an Agency wide process for quality assurance of scientific input to decisions.
39. It was noted that both the SEFSC and the NEFSC are working on technology to automate video/image processing. Over the years, this type of technology development has been pursued in many Centers. Should there be a single national effort (with a critical mass and strategic leadership and priority setting) rather than leaving it individual regions to patch together development efforts?

APPENDIX 4 : DESCRIPTION OF A NATIONAL PROCESS FOR PROGRAM REVIEWS

[Includes text extracted from the Draft Policy Prepared by NMFS-Appendix 5]

What is the Purpose of National Program Reviews?

Is NMFS doing the right science right, using appropriate state-of-the art techniques and technology, and are the results of the science being undertaken efficiently and effectively communicated to the nation?

The NOAA Administrator regularly emphasizes NOAA's role as a science-based agency to a wide variety of audiences (e.g., Administration, Congress, academia, regulated and user communities, and the general public). The importance of high quality science is fundamental to the agency. To maximize the transparency and effectiveness of *major* intramural science programs located at the six Science Centers and those located in NMFS Headquarters, and to ensure that NMFS scientists are conducting high quality scientific investigations of significant value to NOAA and the nation, NMFS should conduct objective external peer reviews of scientific activities currently underway or completed in select major programs at its Science Centers on a *regular basis* using agreed upon *criteria*. These regular external reviews of select programs will evaluate the relevance, quality, performance, and management of its intramural science and to assess progress in meeting goals and objectives as specified in such documents as the NOAA Strategic Plan, NOAA Fisheries Service Research Plan, individual Program Charters administered by the NOAA Office of Program Planning and Integration, and priority information needs identified by nation's eight fishery management councils.

What is the Impetus for Science Program Reviews?

In a document entitled *Fisheries Science Center Accreditation Standards* (2002), the NMFS Science Board, comprised of Science Center Directors and the Director of the Office of Science and Technology, evaluated existing science quality measures at the Science Centers as a step toward developing a unified set of standards for Center science integrity and peer review. It was stated that NMFS science programs and their products would be evaluated to ensure that the NMFS mission is accomplished based on the best available science and to maintain and improve credibility in NMFS' science programs.

In 2004, the Office of Management and Budget (OMB) reported that a wide variety of authorities inside and outside of government have argued that peer review practices at federal agencies need to be strengthened. OMB rightfully noted that peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community.

On January 21, 2009, the President issued a Memorandum on Transparency and Open Government and called for recommendations for making the Federal government more

transparent, participatory, and collaborative. The White House Office of Science and Technology Policy is currently assessing whether government information should be more readily available on-line or more easily searched. How might the operations of government be made more transparent and accountable was an important consideration.

On April 30, 2009, the House Committee on Science and Technology Subcommittee on Investigations and Oversight held a hearing on the role of the Office of Information and Regulatory Affairs, particularly the way it uses or challenges scientific information and its relationship to federal regulatory agencies. The Committee was particularly interested in the quality and transparency of scientific information produced and disseminated.

On November 2, 2009, a memorandum from the NOAA Senior Science Advisor to the NOAA Research Council Chair requested that NOAA establish consistent, agency-wide peer review and monitoring processes for all NOAA scientific activities. This included corporate guidance for standardizing and institutionalizing peer review procedures for all laboratories, science centers, and major research programs across the agency.

What was the NOAA Fisheries Policy on Science Program Reviews prior to adopting this policy?

As reported to the NOAA Research Council in June 2009, NMFS currently has no specific policies regarding when science reviews take place or what criteria will consistently be used to review the science undertaken at the Centers. NMFS conducts reviews as deemed necessary or required. Generally, they occur on an "as needed" basis. Some events that may trigger a review are changes or improvements have taken place since the last review or because it's been “a while” since a previous review. Most reviews to evaluate and strengthen the research being conducted by the Science Centers are usually not laboratory specific but are rather program specific.

Although no overall agency-specific review policy exists, measures are currently in place to guide the quality of science at each of the six Science Centers, but they range broadly in content and scope. Recent program review and processes for science quality assurance are described by Sissenwine and Rothschild (2011. Building Capacity of the NMFS Science Enterprise).

What are the National Programs Program?

The National Marine Fisheries Service has a vast and diverse portfolio of scientific activities. They need to be categorized into National programs to serve as units for review. While it is likely programs formed by categorizing activities will be mostly a collection of scientific activities, the goal of program reviews is identify opportunities to integrate, find efficiencies, pool resources so they are above a critical mass level, and ultimately to create a program that is greater than the sum of its parts.

Some programs will have a long term research perspective and others will be operational, delivering advice and/or data for immediate or short term applications. Long term research programs should have a high degree of innovation, but these programs should also make investments in the transitioning of research to operations. Operational programs will place priority on standardization of processes, but they should also invest in innovation to improve operations in the future by connecting with longer term research programs. By design, interactions between scientific activities within programs should be greater than between programs, but program boundaries are imperfect, and cross program interactions are necessary for research to transition to operations. In fact, this is the reason for NMFS Science Centers and the NMFS Science Enterprise exists on a continuum from long term mission oriented research to operational products, such as scientific advice, supported by an observing system.

Defining National Programs should be based on the following considerations:

1. So they are inclusive of all most all scientific activities with relatively little ambiguity about which activities are included in the program (i.e., clear boundaries).
2. There should be about five programs so that all of NMFS science is reviewed on about a five year cycle. They should be similar in size so that the program review workload is reasonable spread over a multiyear cycle.
3. Similar activities should be in the same Program. The challenge is to decide if similarity is in terms of:
    a. The mission orientation of the activities. Is it in support of the MSFCMA, ESA, MMPA, an aquaculture policy, or some other mission?
    b. Scientific disciplines, such as biological sciences, physical sciences, social sciences, or more specific disciplinary categories (e.g., biological oceanography, eco-toxicology, operations research).
    c. Type of the scientific activity, such as mathematical modeling, research vessel operations, laboratory experimentation, technology development.
    d. Nature of the scientific problem being investigated, such as status and trends of ecosystem and human activities that affect ecosystems, food web dynamics and energy flows, bio-physical coupling in ecosystems including the affects of climate change, functional value of habitats including the role of biodiversity, or the scientific basis for use of living marine resources.

e. Position along the continuum from long term mission oriented research to applications.
f. Some other dimension of a multi-dimensional matrix.

All of the activity dimensions should be considered in defining Programs and assigning activities to them, but program definition is too complex to strictly assign activities according to a single dimension. Program design is analogous to applying principle component analysis to a multivariate set of data. This might be done, but for now, Programs are defined based on subjective judgments based on considerations 1-3 above. The programs, in order of priority for program reviews, are:

1. ***Fisheries science***- This program is primarily operational. It is a high priority for review because of recent changes in scientific requirements to support fisheries management (e.g., end overfishing, Annual Catch Limits) and recent Agency policies (e.g., catch shares). The program includes:
    a. Population biology such as studies of age, growth, reproduction, and stock structure,
    b. Population dynamics and stock assessments,
    c. Social and economic impact assessments,
    d. Evaluation of management options, including management strategy evaluation,
    e. Innovation on new analytical methods or technologies for studying population biology more efficiently.
    f. Innovative methods to take account of regime shifts, climate change, trophic interactions, etc, in scientific advice.
    g. Processes for quality assuring scientific advice.
2. ***Conservation science***- This program is a mixture of operational science and research. It is relatively high priority because it is a large program with important policy implications, and management of the activities in this program has been an issue. The program includes:
    a. Population biology of species of concern because they are, or are candidates for, legal protections, they are keystone species in term of ecosystem function, or they have special societal importance.
    b. Definition of populations units such as distinct population segments (DPS) and evolutionarily significant units (ESUs).
    c. Evaluation of population trends, assessment of extinction risk, criteria for listing species, and potential biological removals (PBRs).
    d. Evaluation of mitigation options, such as bycatch reduction (e.g., turtles in shrimp trawl, large pelagic long line and scallop dredge fisheries), preventing marine mammal entanglement (in gillnets and lobster trap float lines), habitat restoration, and conservation aquaculture. The focus should be on the value of the methods for conserving species, not the research and development of the methods.

e. Research on the functional value of biodiversity (why and how is it important).
f. Processes for quality assuring scientific advice.

3. ***Observing systems-*** This program is mostly operational, but there should be investments to advance observing system technology. It is large program that deserves priority attention, but the optimal design depends on the data needs of the Fisheries Science and Conservation Science Programs. The Program includes:
    a. Systems for collection of fishery dependent data on commercial and recreational catch, effort, bycatch and discards, characteristics of fleets and participation, costs, revenues and other economic data.
    b. Monitoring of ecosystems including fishery resources, protected species, other components of ecosystems, environmental variables. Observing system platforms potentially include surveys vessels, underwater vehicles (e.g., AUVs), aircraft, buoys, and satellites.
    c. Conservation engineering to reduce bycatch, interactions with protected species and habitat alterations.
    d. Cooperative research with the fishing industry (which usually involves collection of fishery dependent data, resource surveys on fishing vessels, or gear development).
    e. Data based design and data management.
    f. Processes for quality assurance of data.
    g. Innovation in advance technology for observing system sensors, data base architecture, and sampling design.
4. ***Ocean ecology-*** This Program is characterized by a high degree of innovation. Due to its size (it is smaller than Programs 1-3) and because there is less immediate pressure on it to perform in terms of the Agency's mission it has a lower priority for a program review. The Program includes:
    a. Research on ecological processes controlling energy flow and nutrient cycling, biophysical coupling, trophic linkages, recruitment processes of exploited and protected species, and resiliency of ecosystems.
    b. Observing technology for investigation of ecological processes, usually requiring different spatial and temporal resolution, sensitivity and discrimination (e.g., of species), than observing system technology.
    c. Advanced research strategies and experimental designs, and analytical methods including biological-chemical-physical models.
    d. Laboratory experiments to support field research.
    e. Comparative analyses of ecosystems.
    f. Design of decision support tools, technologies and protocols for transitioning research results to applications
5. ***Habitat ecology and ecosystem health-*** This program is characterized by a mixture of baseline surveys and innovative research. It includes aquaculture

research because of some disciplinary similarities and to help even out the size of the programs. The program includes:

a. Habitat mapping
b. Research on the functional value of habitat. How does it affect the production function of exploited species and vital rates (growth, mortality, reproduction) and protected species? A goal of the research should be to provide an objective scientific basis to define or characterize ecosystem health.
c. Eco-toxicology to assess the impacts of pollution (metals, synthetic. contaminants, pathogens, nutrients) on species and ecosystems.
d. Research on non-endemic species, such as mechanisms for undesirable introduction, factors making ecosystems susceptible to invasions, impacts of invasions, and mitigation options.
e. Coral reefs ecology, including status and trends, functional value, trophic cascades, the role of grazers, and the effects of fishing, diseases, coral bleaching and ocean acidification, etc.
f. Research and development of habitat restoration technology.
g. Aquaculture research on commercial production, environmental impacts of aquaculture, and conservation of endangered species.
h. Investments in innovative methods for assessing the health of ecosystems.
i. Design of decision support tools, indicators, technologies and protocols for monitoring ecosystem health and identifying essential fish habitat for fishery resources and critical habitat for protected species.
j. Processes for quality assuring advice on essential fish habitat and critical habitat.

It is important to distinguish between the priority for program reviews and the importance of the Program. For example, the Ocean Ecology Program has a relatively low priority for a program review, but it may be the most important Program for advancing the Agency's capability to fulfill its mission in the long term. All of the Programs are important, and they should be subjected to program reviews as soon as possible, but it is not feasible to review them all at once.

What is the Schedule for Program Review?

One Program should be reviewed annual. With five Programs, this approach adheres with the general idea of five-year strategic science plans.

What are the Focus Areas for Review/Questions to be Addressed?

I. **Relevance:** Extremely important questions such as "why is the project being undertaken?" and "what management decision will need this information?" are always

presented to regulatory agencies in budget-trying times. Further questions may include:

- Does the major science program being undertaken address relevant societal needs, now and projected in the future, both domestically and internationally (e.g., is the Center undertaking the right science and doing it right)?
- Is scientific knowledge being advanced and do projects completed by program scientists provide what natural resource managers and policy makers need to make informed decisions? An example of a significant program outcome is the adoption of a new management strategy based upon scientific data.
- Are the projects that are selected for funding fulfilling NOAA/NMFS missions, goals, and objectives?
- Can the program's impact on society, the economy, and the environment be measured?

How well does the Program address the following policies and planning documents is certainly an importance consideration in assessing relevance:

- 2005-10 Strategic Plan for NOAA National Marine Fisheries Service
- NMFS Strategic Plan for Fisheries Research (August 2007)
- NOAA 5-Year Research Plan (2008)
- Fisheries Science Center Accreditation Standards (February 2002)
- Regional Planning Documents (e.g., Gulf of Mexico, Puget Sound, Florida Bay)
- NOAA Office of Program Planning and Integration Program Charters
- Annual priority information needs submitted by the appropriate fishery management council

II. **Quality:** Programmatic investments (inputs) should lead to products (outputs) that produce results and impacts in response to specific planning goals and objectives to address NOAA/NMFS mission goals and objectives. These outputs can be evaluated in either a numerical or qualitative manner or most likely using a combination of both. Some indication of the degree of distinguished and outstanding science being produced by program scientists *may* be measured by:

- What are the total number of publications (including externally reviewed refereed ones) being produced per year by the program and by the individual scientists;

- How "significant" are the publications in contributing to new scientific knowledge, addressing a priority information need, and/or leading to a management action?
- What is the number of citations for the program's scientific staff?
- What awards were received by staff from other government agencies, environmental groups, or scientific peers?

Experts conducting the reviews may select other measures relative to the quality of the science.

III. **Effectiveness**

- In general are the approaches to fulfill the NOAA/NMFS mission objectives well conceived?
- Has the science undertaken in the selected major programs addressed important problems?
- For the stated objectives, has the science undertaken in the selected program produced significant findings?
- Are the aims of the project(s) in the selected program being achieved?
- What is the area of impact of the products developed (e.g., local/state, regional/national, international)?
- Were there any partners that worked on developing these products? What has been their role?

Connecting the selected science program with users and other stakeholders may be assessed by examining the:

- Engagement with appropriate user communities
- Use of partnerships

IV. **Program Management:** In order to determine the effectiveness of Center programs in meeting the agency's goals and providing high quality and cutting-edge science, it is important for the Headquarters, Center Directorate, Program Leaders to provide the necessary communication, tools, and resources to implement an integrated science approach.

- Is the support the selected program scientists receive appropriate in terms of budget, IT support, equipment, and infrastructure?

- Are program scientists appropriately trained and well suited to carry out the projects being pursued?
- What type of tracking is in place for: Research projects? Fiscal matters? Outreach activities? Accomplishments and benefits?
- Are effective and visionary long-range planning, development, and adherence to a strategic and implementation plan in place to guide information and budgetary decisions?

V. **Scientific Leadership and Planning.** Adequate planning for successfully undertaking projects that lead to a desired product and/or management action is very important in alleviating any unforeseen negative circumstances. If a team of experts undertakes the projects, leadership and direction throughout is essential.

- Are program scientists taking advantage of useful collaborative arrangements with external entities?
- Is the work proposed appropriate to the experience level of the principal investigator and other researchers (if any)?
- Do the projects undertaken in the major program employ novel concepts, approaches, or methods?
- Do the projects lead to challenging existing paradigms or developing new methodologies or technologies to address complicated management questions?

Do the contributions of program scientists result in requests for their participation in a leadership capacity in influential coastal groups at the local, state, and national levels?

VI. **Transition: How well has the Selected Major Program Delivered Products?**

- What are the contributions of the selected major program to science and engineering such as fostering a new understanding of products, processes, and technology and how were the products delivered (e.g., publications, patents, other)?
- Are the publications of peer reviewed research papers and other publication formats (e.g., reports, NOAA Tech Memos) commensurate with the size of other Center's programs?
- What is the ability of the science being undertaken by the program to transition to scientific advice and management actions?

How should National Program Reviews be Conducted?

The Director of Scientific Programs is responsible for the National Program Review Process. The Process will be guided by a National Program Review Panel (NPRP) of independent science leaders. The National Program Review Panel will be comprised of five to seven members:

1. With scientific experience as researchers, administrators and leaders, with National and/or International stature,
2. Knowledge of the subject matter of one or more of the NMFS Programs in most cases, but some members may have knowledge and experience with other subjects (e.g., forestry, epidemiology of human diseases) that require similar disciplines and comparable mandates.
3. Serving for five year terms, except that some of the initially members will be appointed for less than five years to stage replacements.
4. Including the Director of Scientific Programs serving as an ex-officio member. This function will not be delegated, although the Director of the Office of Science and Technology may represent the Director of Scientific Programs under unusual circumstances.

There will be an open solicitation for members of the Panel. The qualifications of Panel members will be reviewed and commented on by the NOAA Science Advisory Board, Marine Fisheries Advisory Committee and/or NRC Ocean Studies Board before members are appointed by the Assistant Administrator for Fisheries.

The responsibilities of the National Program Review Panel will be:

Agree on the scientific activities included (and not included) in National Programs subject to each annual review.

1. Decide on the background documents to be assembled for the review and certify that assembled documents are satisfactory to proceed with the review.
2. Decide on site visits, mechanism for obtaining stakeholder input and the schedule for the review.
3. Select Program Review Team members.
4. Oversee preparation of, and approval of, the Program Review Report.
5. Review the Agency Action Plan describing responses to Program Review findings and recommendations, and monitor progress implementing the Plan.

The Program Review Panel will select its own rotating chairs for one year terms. Over the course of the five years members serve on the Panel, they will chair one year and have the lead as chair for the review of one National Program.

Program Reviews will include a presentation of a comprehensive overview (envisioned as about two days) of the Program to the Program Review Panel. It will be followed by site visits by Program Review Teams (PRTs). There will be several site visits to assure there is

time and opportunity to review and discuss all aspects of the Program and to hear from stakeholders. However, it may not be necessary to conduct site visits in every region.

Program Review Teams will be composed of independent scientists with experts in the subject matter of the Program (in general, they will be more specialized than Program Review Panel members). At least one stakeholder or user (e.g., of fishery management advice) should be included on each Team. Users might be from within the Agency, such as a Regional Administrator or Assistant Regional Administrator, but they should not be from the same region as the site visit. The teams will be chaired by a Program Review Panel member. Additional Panel members will serve on the Teams to the extent practical given workloads.

Program Review Teams will prepare site visit reports under the leadership of the Panel member that chairs the Team. The Panel will meet to prepare a consensus Program Review report based on the Team reports and its own analyses and considerations, as appropriate. The report will have findings and recommendations.

The Director of Scientific Programs will participate in all aspects of the work of the Panel, except for the preparation of findings and recommendations. The Panel can conduct executive sessions (with only independent members present) if it deems it necessary.

The process of preparing for a Program Review, conducting the National overview briefing, site visits, and finalizing a report will take about nine months annually. The Agency will prepare an Action Plan in response to the Program Review report within 3 months.

There will be a Program Review Data Base (PRDB) that will include:

1. Background documents prepared for program reviews,
2. Presentations made at the National overview briefing and at site visits,
3. Written input from stakeholders and users,
4. Site Visit reports,
5. Program Review Reports,
6. Action Plans responding to program reviews
7. A tracking system for monitoring progress implementing Action Plans.

To the extent practicable, the data base should have search capability. It should be designed in a manner that facilitates consistency between regions and Programs to enhance comparisons. It should have report preparation capability that allows user specified types of information to be extracted and associated with other types of information (e.g., a report on resource surveys that collect plankton samples, laboratory experiments on salmon from the Columbia River system, cooperative research with the fishing industry that involves collection of fishery dependent data; such reports should associate activities with budgets and staff).

Report preparation capability is necessary because this will be a large database. It is unrealistic and inefficient for anyone to read it all. A database of summarized information avoids the problem of "drowning" users in information, but such data bases are seldom adequate to answer specific or detailed questions that arise during a program review. They usually lead to a stream of supplemental requests, delays, and frustration. Also, databases of summarized information become obsolete quickly. A better solution is a modern Management Information System of detailed continuously updated data on activities, personnel and budgets, that is searchable with sophisticated capability to extract information and create reports according to user specifications. Information technology is not the limiting factor.

The Program Review Database will be maintained by the Program Review Staff (PRS). The staff will work with the Programs to make sure information is prepared in a consistent and comparable manner. They will also carry out assignments given by the Program Review Panel to help prepare reports. They will be responsible for coordinating meetings including site visits. The PRS will be composed of a senior staff member (part time) and additional mid level or junior staff as necessary.

The workload of the Program Review Panel members, especially the Chair, will be considerable. Therefore they will be offered compensation in the form of honoraria, plus expenses. Travel expenses of Program Review Team members will be paid by the Agency. Travel expenses of Agency participants in the program review activity will be the responsibility of their own organization.

The Director of Scientific Programs will prepare an annual budget for the National Program Review Process for Agency approval.

What May be the Projected Outcome of this Program Review Process?

The process will formally establish a formal quality assurance program and systematic process for regular peer review of National Programs. External peer review will ensure that Programs are conducting high quality science of significant value to NMFS, NOAA and the Nation and will ultimately improve the quality and functional utility of all the NMFS Science Enterprise by improving resource management decisions or solving problems of concern to NOAA and the Nation.

APPENDIX 5: DRAFT DOCUMENT PREPARED BY NMFS OFFICE OF SCIENCE AND TECHNOLOGY

DRAFT PROPOSAL TO ESTABLISH A SYSTEMATIC PROCESS FOR PEER REVIEW OF SELECT INTRAMURAL SCIENCE PROGRAMS AT THE SCIENCE CENTERS OF THE NOAA FISHERIES SERVICE (NMFS)

What is the Purpose of Reviewing Select Programs at the Science Centers?

Is NMFS doing the right science right, using appropriate state-of-the art techniques and technology, and are the results of the science being undertaken efficiently and effectively communicated to the nation?

The NOAA Administrator regularly emphasizes NOAA's role as a science-based agency to a wide variety of audiences (e.g., Administration, Congress, academia, regulated and user communities, and the general public). The importance of high quality science is fundamental to the agency. To maximize the transparency and effectiveness of *major* intramural science programs located at the six Science Centers and those located in NMFS Headquarters, and to ensure that NMFS scientists are conducting high quality scientific investigations of significant value to NOAA and the nation, NMFS should conduct objective external peer reviews of scientific activities currently underway or completed in select major programs at its Science Centers on a *regular basis* using agreed upon *criteria*. These regular external reviews of select programs will evaluate the relevance, quality, performance, and management of its intramural science and to assess progress in meeting goals and objectives as specified in such documents as the NOAA Strategic Plan, NOAA Fisheries Service Research Plan, individual Program Charters administered by the NOAA Office of Program Planning and Integration, and priority information needs identified by nation's eight fishery management councils.

What is the Impetus for Science Program Reviews?

In a document entitled *Fisheries Science Center Accreditation Standards* (2002), the NMFS Science Board, comprised of Science Center Directors and the Director of the Office of Science and Technology, evaluated existing science quality measures at the Science Centers as a step toward developing a unified set of standards for Center science integrity and peer review. It was stated that NMFS science programs and their products would be evaluated to ensure that the NMFS mission is accomplished based on the best available science and to maintain and improve credibility in NMFS' science programs.

In 2004, the Office of Management and Budget (OMB) reported that a wide variety of authorities inside and outside of government have argued that peer review practices at federal agencies need to be strengthened. OMB rightfully noted that peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community.

On January 21, 2009, the President issued a Memorandum on Transparency and Open Government and called for recommendations for making the Federal government more transparent, participatory, and collaborative. The White House Office of Science and Technology Policy is currently assessing whether government information should be more readily available on-line or more easily searched. How might the operations of government be made more transparent and accountable was an important consideration.

On April 30, 2009, the House Committee on Science and Technology Subcommittee on Investigations and Oversight held a hearing on the role of the Office of Information and Regulatory Affairs, particularly the way it uses or challenges scientific information and its relationship to federal regulatory agencies. The Committee was particularly interested in the quality and transparency of scientific information produced and disseminated.

On November 2, 2009, a memorandum from the NOAA Senior Science Advisor to the NOAA Research Council Chair requested that NOAA establish consistent, agency-wide peer review and monitoring processes for all NOAA scientific activities. This included corporate guidance for standardizing and institutionalizing peer review procedures for all laboratories, science centers, and major research programs across the agency.

What is the Current NOAA Fisheries Policy on Science Program Reviews?

As reported to the NOAA Research Council in June 2009, NMFS currently has no specific policies regarding when science reviews take place or what criteria will consistently be used to review the science undertaken at the Centers. NMFS conducts reviews as deemed necessary or required. Generally, they occur on an "as needed" basis. Some events that may trigger a review are changes or improvements have taken place since the last review or because it's been “a while” since a previous review. Most reviews to evaluate and strengthen the research being conducted by the Science Centers are usually not laboratory specific but are rather program specific.

Although no overall agency-specific review policy exists, measures are currently in place to guide the quality of science at each of the six Science Centers, but they range broadly in content and scope. Many of the scientific products developed by Center scientists are reviewed via a number of different mechanisms. The Southeast Fisheries Science Center (SEFSC) in Miami, for example, utilizes several avenues including the Center of Independent Experts CIE); the Standing Committee for Research and Statistics of the International Commission for the Conservation of Atlantic Tunas; and the review of the Cooperative Institute of Marine and Atmospheric Studies. Population assessment documents are peer reviewed through a panel process that includes world-renowned, independent, reviewers. The SEFSC has a standing review schedule for the review of some specific scientific products, such as stock assessments, via the Southeast Data, Assessment, and Review (SEDAR) process.

The Pacific Islands Fisheries Science Center (PIFSC) in Honolulu conducts general laboratory and topic specific reviews on an annual basis, has also used the CIE for both specific scientific product and broader reviews on varying topics and posts the results of both types of these reviews on their web site, and works with the Western Pacific Fishery Management Council in collaborative stock assessments receive peer reviews (termed WPSAR) under the Magnuson-Stevens requirements for such reviews.

The Northwest Fisheries Science Center (NWFSC) in Seattle has relied on external scientific panels to provide a detailed evaluation of the Center's research and infrastructure capabilities and needs. The format for these reviews has included detailed background material for panel members to review in advance, presentations by key Center research personnel, interviews with as many staff as possible, and informal meetings with constituents of the Center's research. After each review, each member of the external panel reports their findings and recommendations independently, and the chair provides a final detailed written report to the Center's Science and Research Director. The Center then develops an action plan to address issues and recommendations raised by the panel. The Center may use panel recommendations to revise its research plans and/or build initiatives for future funding. As a research plan is a living document, the NWFSC research plan is usually internally reviewed and near-term priority projects refreshed, approximately every 2-3 years.

The Southwest Fisheries Science Center in La Jolla, CA. **(insert paragraph with example(s))**

The Northeast Fisheries Science Center in Woods Hole, MA. **(insert paragraph with example(s))**

The Alaska Fisheries Science Center in Seattle **(insert paragraph with example(s))**

There may be times when Center science programs are reviewed as part of a larger NOAA or NMFS-wide review (e.g., the Department of Commerce's Inspector General review of the Observer Program entitled "NMFS Observer Programs Should Improve Data Quality, Performance Monitoring, and Outreach Efforts"(Draft Inspection Report No. IPE-15721/January, 2004). Programmatic reviews may be comprised of a set of activities at a particular laboratory (e.g., the Headboat Survey Program at the Beaufort Laboratory) or may be integrated across more than one laboratory (e.g., the Coral Reef Conservation Program).

Another review of the science being conducted at all of the Centers involves publications. The NOAA Fisheries Service has a standard review policy for publications. One's supervisor and internal peers review manuscripts before being sent for publication in externally peer reviewed and refereed journals, proceedings, and book chapters. All

internal review comments are provided on NOAA Form 25-700 for author revisions, if necessary, before the manuscript is sent out for publication consideration.

What is a *Major* Program?

The review is for selected major science programs at the Center and its affiliated field offices and laboratories. One option to define what constitutes a *major* science program within a Science Center would be the areas NMFS has identified for spending plans as its principal programs.

Major programs require a more complex governing structure because they involve addressing clearly articulated goals and objectives and expenditures with potentially significant bottom-line impact. The external review of the major science programs identified by the Center Director will form the evaluations and assessments found within the six NMFS Science Centers.

Major science programs within a Center can be organizational (e.g., a Division or Branch) or thematic (e.g., coral ecosystem conservation and assessment, stock assessment) in nature. They are labeled as such because they either (a) comprise a "significant" proportion of the overall financial resources of a particular Science Center; and/or (b) comprise "significant" numbers/percentage of human resources (e.g., FTE's and contractors at that particular Science Center; and/or (c) are deemed scientifically critical (e.g., identifying essential fish habitat, protecting and restoring endangered and threatened species) to fulfilling the goals, objectives, and mandates of both NOAA and the NOAA Fisheries Service; and/or (d) are deemed to be politically sensitive (e.g., salmon protection, marine protected area development and assessment).

What constitutes a major program may cut across many scales, whether they are part of a larger national or multi-Center effort or be entirely Center-specific. Again, the definition of what constitutes a major program and the rationale used to identify these programs must be clearly stated and agreed upon by all appropriate parties before external reviewers are ever approached.

The Science Center Director and NMFS Chief Science Advisor will agree upon the number and identification of each Center's major science programs to be reviewed. It is envisioned that the number of major science programs that will be regularly reviewed at each Center will be approximately 4-6.

What is Considered Review on a *Regular* Basis?

At the beginning of each calendar year, 1-2 major science programs will be identified by each of the six Science Center Directors to be externally reviewed that year. With six or so *total* major programs identified from each Center, this schedule would ensure that each major science program never goes longer that five years (e.g., a total of six or so major programs from each Center with 1-2 reviewed each year) without being externally

reviewed. This frequency also adheres with the general idea of five-year strategic science plans.

What are the Focus Areas for Review/Questions to be Addressed?

VII. **Relevance:** Extremely important questions such as "why is the project being undertaken?" and "what management decision will need this information?" are always presented to regulatory agencies in budget-trying times. Further questions may include:

- Does the major science program being undertaken address relevant societal needs, now and projected in the future, both domestically and internationally (e.g., is the Center undertaking the right science and doing it right)?
- Is scientific knowledge being advanced and do projects completed by program scientists provide what natural resource managers and policy makers need to make informed decisions? An example of a significant program outcome is the adoption of a new management strategy based upon scientific data.
- Are the projects that are selected for funding fulfilling NOAA/NMFS missions, goals, and objectives?
- Can the program's impact on society, the economy, and the environment be measured?

How well does the Center's major science programs being reviewed address the:

- 2005-10 Strategic Plan for NOAA National Marine Fisheries Service
- NMFS Strategic Plan for Fisheries Research (August 2007)
- NOAA 5-Year Research Plan (2008)
- Fisheries Science Center Accreditation Standards (February 2002)
- Regional Planning Documents (e.g., Gulf of Mexico, Puget Sound, Florida Bay)
- NOAA Office of Program Planning and Integration Program Charters
- Annual priority information needs submitted by the appropriate fishery management council is certainly an important consideration in assessing their relevance.

VIII. **Quality:** Programmatic investments (inputs) should lead to products (outputs) that produce results and impacts in response to specific planning goals and objectives to address NOAA/NMFS mission goals and objectives. These outputs can be evaluated in either a numerical or qualitative manner or most likely using a combination of both.

Some indication of the degree of distinguished and outstanding science being produced by program scientists *may* be measured by:

- What are the total number of publications (including externally reviewed refereed ones) being produced per year by the program and by the individual scientists;
- How "significant" are the publications in contributing to new scientific knowledge, addressing a priority information need, and/or leading to a management action?
- What is the number of citations for the program's scientific staff?
- What awards were received by staff from other government agencies, environmental groups, or scientific peers?

although the experts conducting the reviews may select measures relating to the quality of the science being reviewed entirely different than the input-output model.

IX. **Effectiveness**

- In general are the approaches to fulfill the NOAA/NMFS mission objectives well conceived?
- Has the science undertaken in the selected major programs addressed important problems?
- For the stated objectives, has the science undertaken in the selected program produced significant findings?
- Are the aims of the project(s) in the selected program being achieved?
- What is the area of impact of the products developed (e.g., local/state, regional/national, international)?
- Were there any partners that worked on developing these products? What has been their role?

Connecting the selected science program with users and other stakeholders may be assessed by examining the:

- Engagement with appropriate user communities
- Use of partnerships

X. **Program Management:** In order to determine the effectiveness of Center programs in meeting the agency's goals and providing high quality and cutting-edge science, it is important for the Center Directorate and Program Leads to provide the necessary communication, tools, and resources to implement an integrated science approach.

- Is the support the selected program scientists receive appropriate in terms of budget, IT support, equipment, and infrastructure?
- Are program scientists appropriately trained and well suited to carry out the projects being pursued?
- What type of tracking is in place for: Research projects? Fiscal matters? Outreach activities? Accomplishments and benefits?
- Are effective and visionary long-range planning, development, and adherence to a strategic and implementation plan in place to guide information and budgetary decisions?

XI. **Scientific Leadership and Planning.** Adequate planning for successfully undertaking projects that lead to a desired product and/or management action is very important in alleviating any unforeseen negative circumstances. If a team of experts undertakes the projects, leadership and direction throughout is essential.

- Are program scientists taking advantage of useful collaborative arrangements with external entities?
- Is the work proposed appropriate to the experience level of the principal investigator and other researchers (if any)?
- Do the projects undertaken in the major program employ novel concepts, approaches, or methods?
- Do the projects lead to challenging existing paradigms or developing new methodologies or technologies to address complicated management questions?

Do the contributions of program scientists result in requests for their participation in a leadership capacity in influential coastal groups at the local, state, and national levels?

XII. **Transition: How well has the Selected Major Program Delivered Products?**

- What are the contributions of the selected major program to science and engineering such as fostering a new understanding of products, processes, and technology and how were the products delivered (e.g., publications, patents, other)?
- Are the publications of peer reviewed research papers and other publication formats (e.g., reports, NOAA Tech Memos) commensurate with the size of other Center's programs?
- What is the ability of the science being undertaken by the program to transition to agency management actions?

What will be the General Basis for Assessing Science Undertaken by the Center?

What was the rate of return on the federal investment and how does that return (products, outcomes, impacts) compare with the stated goals and objectives of the Program's projects? The evaluation of these returns can be subjective and is a mixture of both quantitative (e.g., how many scientific publications and reports? do the projects meet or do not meet stated goals and objectives?) and qualitative (e.g., how important are the results to decision makers? what is the impact of the research results?) measures. While the reality is that there probably is not a set formula for presenting a case where a particular review process clearly demonstrates performance, Program Leads should be able to provide reviewers a clear rationale for how investment decisions are made and determine if the desired impacts were achieved. The criteria and benchmarks used in the review should be identical for all the Centers select programs receiving review. The general benchmark indicators suggested below will help provide a common framework for evaluations across all of the Centers select programs.

How Will External Reviewers be Selected?

As peer review involves the review of products for quality by specialists in the field who were not involved in producing the product, there are a number of peer review models that can be used (e.g., all external reviewers or a combination of external, non-NOAA Government, and NOAA experts). The selection of participants in a peer review is based on expertise, with due consideration of independence and conflict of interest. One member of the review team will be another Center Director and/or the Director of the NMFS Office of Science and Technology and/or his/her NMFS designee. This will ensure that someone on the review team has the expertise in the way NOAA/NMFS conducts "business" (e.g., PPBES process, political mandates and earmarks, hiring procedures, financial resources). The 3-4 external reviewers selected should have a substantial representation of high-ranking and broadly experienced scientists, science administrators, and stakeholders from outside NOAA who are qualified to evaluate the effectiveness, efficiency, and contributions of a large scientific or resource management enterprise. These expert reviewers could be selected by/from the Center for Independent Experts (http://www.rsmas.miami.edu/groups/cie), a Host University or partner of a particular Cooperative Ecosystem Studies Unit (www.cesu.org), a NOAA Cooperative Institute with knowledge of the Center's work (www.nrc.noaa.gov/ci) or another means (e.g., contractors not affiliated with any CIE, CESU, CI). Any person possessing the necessary expertise in the relevant scientific discipline being reviewed may be a candidate for selection as an external reviewer by NOAA Fisheries officials. The Center Directors will nominate a list of individuals possessing the necessary expertise and send the nomination list to the Chief Science Advisor for his/her concurrence. The Chief Science Advisor will make the final selection of the 3-4 reviewers.

How May the Review be Conducted?

The NMFS Chief Science Advisor (with support from the Director of the Office of Science and Technology) will be responsible for the overall conduct of the review. Review Team members will be provided with summaries of the select major programs to be reviewed and their contacts. Background materials would be sent out electronically via a private website beforehand by the Center Director and/or Program Leads to all Review Team members. The Review Team would then meet at the location housing the major program(s) under review to enable them to interview program/project leaders and other key personnel.

What May be the Roles and Responsibilities of NMFS Officials for Select Program Reviews?

- **Assistant Administrator (AA).** The AA discusses the final summary report from the Review Team with the NMFS Chief Science Advisor and actions to be taken as a result of the reviews.

- **Director of Scientific Programs and Chief Science Advisor.** The NMFS Chief Science Advisor authorizes and approves all policies associated with review and evaluation of the select Center programs. The NMFS Chief Science Advisor is the lead management official for conducting select Center program science reviews and works closely with the Review Team, appropriate Center Director and Program Leads, and Director of the Office of Science and Technology (where the Science Quality Assessment Program resides) to develop review schedules and meets with the Review Team through any appropriate means (in person, teleconference, email) to plan the select Center program reviews.

- **Science Center Directors and Program Leaders.** Each Center Director will work with the Chief Science Advisor and Review Team Chair to define the scope, emphasis, and issues of the select program science reviews. In accordance with what is to be reviewed, the Center staff identified by the Director prepares the appropriate briefing materials, responses to specific questions from the Review Team, and other pertinent information. The Director will instruct the Center Webmaster to develop and maintain a review website. The Director will identify a Center Review Coordinator to work with the Chief Science Advisor, Review Team, and Headquarters.

- **Director, NOAA Fisheries Office of Science and Technology (S&T).** The S&T Director will appoint a person to tend to the day-to-day management of the annual reviews and to ensure that materials are posted in a timely manner, logistics are taken care of, and the timeline agreed upon is adhered to.

- **Chair, NOAA Fisheries Science Board.** In consultation with the Chief Science Advisor, the Science Board Chair ensures that the review process is implemented in accordance with the Center Science Review Implementation Plan. In collaboration with the appropriate Center Director, the Science Board Chair reviews and records the

final review panel recommendations and tracks and monitors the implementation of the recommendations.

What is a Possible Annual Calendar for Reviews Each Year?

1. Preparation for the Review

- **January:** The Chief Science Advisor works with the Center Directors and Director of the Office of Science and Technology to **identify the 1-2 intramural programs/areas to be reviewed** during that annual review cycle.

- **March:** The appropriate Center Directors **develop a Scope of Work for their selected review(s)** and submits it/them to the Chief Science Advisor for review and approval. The CIE, a relevant CI or CESU is engaged to assist with recommending review team members, if necessary.

- **April: Review Team members are identified** to the Chief Science Advisor for discussion/concurrence. The Chief Science Advisor and/or his/her designee contacts potential reviewers request their service on the review panel. A letter from the Chief Science Advisor, including the charge to the reviewers, is provided to the proposed reviewers who have agreed to serve.

- **May:** A meeting/teleconference is held between the Chief Science Advisor and the reviewers to discuss the proposed agenda, charge to reviewers, information available, logistical arrangements, and get any feedback on what additional information is required. A private website is developed by the Center being reviewed to post information for the reviewers.

- **July - October: Programmatic reviews are undertaken.** Taking into account Center seasonal field sampling schedules and requirements, reviewers will schedule programmatic reviews as the opportunity presents itself during this time window

2. Suggested Completion of the Review Report

Within *30 days* after the review, the Chair of the Review Team will provide a draft copy of the review report to the Chief Science Advisor. Within a *30-day* period, the Chief Science Advisor will review the report and submit any corrections or suggestions to the members of the Review team. Within *30 days* after the corrected report is received, the Review Team Chair will submit a final review report to the Chief Science Advisor.

3. Implementation of Review Recommendations

Within *30 days* of receiving the final review report, the Center Director will develop and submit to the Chief Science Advisor an implementation plan for recommendations from the report for his/her review and approval. After discussion, a final proposed implementation plan will be submitted to the AA within *30 days*.

Within *30 days* of approving the implementation plan, the AA will send the Executive Director the final proposed implementation plan. Within *6 months* of the completion of the final implementation plan, the Chief Science Advisor will assess the actions taken by the Center to implement the review recommendations and report his/her findings to the AA.

What May be the Projected Outcome of the Review?

If implemented, this proposal would establish a formal quality assurance program and systematic process for regular peer review of select major intramural science programs undertaken by the Science Centers. External peer review would ensure that the Center's program scientists are conducting high quality science of significant value to NOAA and the nation and will ultimately improve the quality and functional utility of all select Center program science by improving resource management decisions or solving problems of concern to NOAA and the nation.

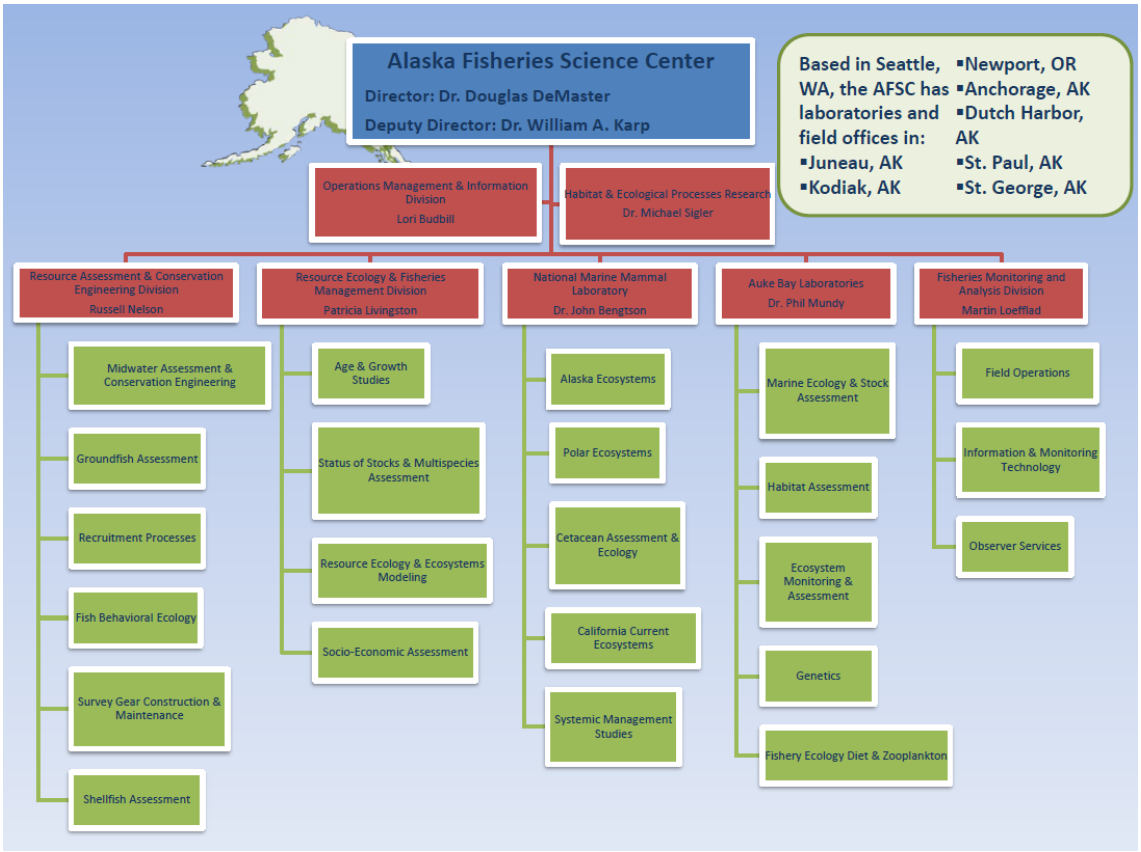
APPENDIX 6. REPORT OF SCIENCE CENTER SITE VISITS

ALASKA FISHERIES SCIENCE CENTER

Organization and programs

The Headquarters of the Alaska Fisheries Science Center is at the NOAA facility at Sand Point, Seattle. The AFSC also has major laboratories in Juneau and Kodiak, Alaska. It has a fiscal year (FY) 2010 budget of $84.3 million, and 397 federal employees and 86 contract personnel.

The AFSC is organized into 5 Divisions as indicated in the following organization chart:



The National Marine Mammal Laboratory and the Fisheries Monitoring and Evaluation divisions are, for the most part, independent divisions in a thematic sense. Programmatic overlap does occur within RACE, REFM and ABL. The FMA Divison was created in 2005. This Division includes the North Pacific Observer Program which was previously a program within the REFM Division. The matrix-managed HEPR Program is used to linking programs across the divisions and implementing inter-disciplinary projects. Nevertheless, our impression is that organization is largely a legacy of the past.

Scientific activities of the AFSC are summarized as follows:

1. Fisheries Assessment Surveys
    a. Conducts fishery surveys and ecological research studying distribution and abundance of fish and crab stocks
    b. MACE uses acoustics (echo integration) surveys combined with midwater trawl to assess walleye pollock
    c. GAP conducts bottom trawl assessment surveys for groundfish and king and Tanner crabs
2. North Pacific Groundfish Observers-
    a. Samples commercial fishery catches (~36,000 observer days in 2009)
    b. Estimation of catch and bycatch
    c. Provides near real-time information for quota monitoring
    d. Trains observers
    e. Performs QA/QC
3. Ecosystem Monitoring and Assessment
    a. Bering Arctic Subarctic Integrated Survey (BASIS): Fisheries Oceanography of Bering Sea: salmon, age-0 pollock and Pacific cod
    b. Southeast Coastal Monitoring (SECM): Fish. Ocean. SE Alaska, stock assessment
    c. Recruitment processes (FOCI Program)
4. Marine Ecology and Stock Assessment
    a. Stock Assessments for sablefish, rockfish, grenadiers and sharks for Council to recommend annual quotas.
    b. Environmental drivers of recruitment processes
    c. Essential fish habitat (EFH) definition, habitat utilization by sensitive life cycle stages, deep water corals and recovery of benthos
5. Habitat Assessment and Marine Chemistry
    a. Researches chemical and ecological processes in marine, tidal, and watershed habitats
    b. ShoreZone Mapping/Fish Atlas: High definition video of coast with embedded database
    c. Nutritional ecology research
    d. Assesses bioenergetics, nutritional value of forage species
    e. Seeks to understand how prey organisms allocate energy between growth, reproduction, and fat storage
    f. Contaminants research
    g. Studies the impact of development and contaminants to fish habitat
    h. Focused on applying lessons learned from *Exxon Valdez* Oil Spill
6. Genetics- Stock Identification
    a. Rockfish species complex identification

    b. International genetic baseline for Pacific salmon meets treaty obligations
    c. Assists management of pollock fisheries with stock identification of salmon bycatch
    d. Develop faster, cheaper methods for genotyping large numbers of fish
7. Fishery Ecology Diet and Zooplankton- Laboratory support for fishery oceanography & stock assessments and multispecies/ecosystem modeling
8. Age and Growth
    a. Provides age data contributing to our understanding of a species - in context of sustainable fisheries, species conservation, and species ecology
    b. Primary focus is providing age data for age structured modeling of exploited fish populations
    c. Conducts research on the effects of climate on growth
9. Stock Assessment and Multispecies Assessments
    a. Determine the condition of fisheries resources
    b. Research focuses on updating information on population dynamic trends, estimation of biological yields, and management strategies
    c. Fisheries Interaction Team studies effects of fishing on top trophic level consumers, including Steller sea lions
10. Economic and Social Sciences Research
    a. Provides information on economic and sociocultural information concerning the conservation and management of Alaska's living marine resources
    b. Collect economic and sociocultural data and develop models to monitor changes in indicators and to estimate the impacts of alternative management measures
    c. Assist the Alaska Regional Office and Council in preparing regulatory analyses
11. Studies of recruitment of commercially important species
    a. Eco-FOCI conducts research on the natural fluctuations of walleye pollock
    b. NPCREP studies climate and ecosystems, particularly the Bering Sea response to ocean warming
12. Bering Sea Integrated Ecosystem Research Program (BSIERP)
    a. Integrated research covering atmospheric forcing and physical oceanography to humans and communities
    b. Focuses on understanding trophic interactions
13. Resource Ecology and Ecosystem Modeling

    a. Analyses trophic interaction information and incorporates these data into environmental assessments and single-species and multispecies models
    b. Seeks to understand how external forces may cause unanticipated shifts in ecosystem composition by quantifying food web linkages
14. Fisheries Behavioral Ecology- Investigates relationships between fish behavior and environmental variables
15. Conservation Engineering- Develop modified fishing gear to reduce the take, or mortality, of bycatch and to lessen the effects of fishing on habitat
16. Research Fishing Gear- Develops scientific fishing gear used for fisheries surveys and research for the AFSC; advises and assists other NOAA west coast survey groups and State agencies
17. Marine Mammal Research-
    a. Alaska Ecosystems- conducts research on Steller sea lions and northern fur seals; assess abundance, stock structure, trends and foraging ecology and understand the role these species play Alaskan ecosystems
    b. Polar Ecosystems- assess pinnipeds in the Arctic, sub-Arctic, and Antarctic ecosystems (e.g., ice seals and harbor seals), research on factors responsible for population dynamics and effects of changing climate
    c. Cetacean Assessment and Ecology- assess the status of cetaceans in Alaska waters, particularly Cook Inlet beluga and North Pacific right whales
    d. California Current Ecosystems- assess the status and trends of marine mammals in WA/OR/CA including long-term demographic studies on pinnipeds, analyses of effects of El Nino, other factors regulating population growth, studies of interactions between increasing pinnipeds and endangered salmonids
18. Studies of loss of Sea Ice (LOSI)
    a. Periodically monitor species in the northern Bering Sea, Chukchi, and Beaufort Seas where northward expansion is expected
    b. Expansion of bottom trawl survey for fish and shellfish into the northern Bering Sea
    c. Prepare for abundance surveys for ribbon, spotted and bearded seals in the Bering Sea and Sea of Okhotsk

Quality assurance

The AFSC does not have a program review policy. Program reviews of some activities of the Center have been conducted intermittently in the past (e.g., 1992 review of the two major divisions that support fisheries management), and some of the Center's research is covered by program reviews of the NOAA Pacific Marine Environmental Laboratory (e.g., AFSC's contributions to FOCI which was reviewed about two years ago).

Since the early 2000s, the AFSC has conducted a series of intense reviews of relatively narrow program areas. Recent reviews have been conducted by scientists appointed by the Center for Independent Experts (CIE) as follows:

- Review of multispecies and ecosystem modeling- 2005
- Review of Salmon Programs of the Auke Bay Laboratory- 2005
- Review of assessments of Alaska rockfish- 2006
- Review of assessment of Alaska sablefish- 2008
- Review of Pollock assessment - 2010

These intense reviews are useful for advancing assessment models, but their narrow focus has limited value in terms of the Center overall. The review of the Salmon Program of the Auke Bay Laboratory was broader than the other CIE reviews and it appears to have resulted in a programmatic reorganization.

Approximately 40 stock assessments are performed annually or biannually. They are reviewed internally (through the Center's chain of command) before they are released to "Plan Teams" made up of State, University and NMFS scientists. The Plan Teams are established by the North Pacific Fisheries Management Council (NPFMC). Plan Teams review the assessments and sometimes require Center scientists to make significant revisions before the assessments are ready for the final stage of peer review. The final review is conducted by the Scientific and Statistical Committee (SSC) of the NPFMC. The SSC is also composed of State, University, and NMFS scientists with a lot of stock assessment expertise. The SSC usually accepts the assessments agreed by the Plan Team, but it can, and occasionally does, reject or modify assessments.

The AFSC's marine mammal research program is occasionally subjected to a review by the Marine Mammal Commission. Assessments of marine mammal populations are reviewed by the Alaska Scientific Review Group (SRG) established by the Marine Mammal Protection Act. SRGs are made up of non-Agency scientists. Assessments of whale populations are intensely reviewed by the Scientific Committee of the International Whaling Commission. The Antarctic marine mammal research of the AFSC is reviewed by the Scientific Committee of the Commission for Conservation of Antarctic Marine Living Resources (CCAMLR).

One important category of scientific product of the Alaska Fisheries Science Center that is not subjected to a formal process of quality assurance is scientific input to Agency decisions under the Endangered Species Act (e.g., listing decisions, recovery plans, jeopardy decisions). The science underlying these decisions is often subjected to intense scrutiny after the fact (for example, an NRC review of factors that potentially threaten Alaskan Stellar Sea Lions), but this is not an appropriate alternative to a credible (with some independent experts, transparency, stakeholder buy-in) pre-decisional quality assurance processes similar to the ones used for fishery management decisions.

Another type of scientific product of the AFSC is scientific publications. The AFSC had 133 external (non-Center) publications in 2009 (e.g., journals, technical reports, books or book chapters subjected to non-AFSC peer review). The AFSC publication policy requires these products to be internally reviewed before they are submitted for publication.

Program management

The Alaska Fisheries Science Center views itself as managed by a Board of Directors (BoD) comprised of the Center Directorate and the Division Directors. The BoD has prepared a Science Plan as a medium term (3-5 years) program management tool. It has three major research themes with twelve foci as follows:

1. Monitor and assess fish, crab and marine mammal populations, fisheries and marine ecosystems.

    - Maintain the current assessment tier of fish, crab, and marine mammal stocks (Core Activity)
    - Support NMFS and North Pacific Fishery Management Council analyses and international obligations (Core Activity)
    - Improve or expand fish, crab, and marine mammal stock assessments and biological and socioeconomic data collections
    - Conduct integrated ecosystem assessments

2. Understand and forecast effects of climate change on marine ecosystems.

    - Monitor and understand the effects of loss of sea ice on marine ecosystems
    - Understand ecological interactions within and between species
    - Understand effects of ocean acidification
    - Forecast indirect effects of climate change on fish, crab, and marine mammal species

3. Describe and assess the role of habitats in supporting healthy marine ecosystems and populations of fish, crab and marine mammals.

    - Assess and evaluate the importance of specific habitat types for fish, crab, and marine mammal populations
    - Evaluate and forecast ecosystem impacts of fishing and develop mitigation tools
    - Evaluate and forecast impacts of human activities (other than fishing) on fish, crab, and marine mammals and their habitats
    - Provide information and analyses to support coastal and marine spatial planning

AFSC plans to prioritize projects and allocate resources through an annual process as follows:

- Center Director issues annual guidance in January-February
- Project/Activity plans are prepared by Division in March-April
- Project/Activity plans are evaluated in May
- Projects and activities are prioritized and tentative resource allocations are planned in June
- Annual budget allocations are made in October-December depending on National budget allocation decisions.

The process is intended to be a collegial process among the Board of Directors. It has not been applied yet, but the AFSC plans to use it in beginning with the 2011 FY.

Other observations

1. It was noted that the Agency budget planning process no long solicits budget initiatives from the Center level. Various staff from HQ sometime solicit Center input, but this is not conducive to coherent, integrated regional program planning.
2. The AFSC was particularly dependent on Congressional add on in recent years, but a recent change in Congressional leadership has severely reduced the availability of such funds. As a result, the AFSC may face more serious budget problems than most of NMFS.
3. The organization of the AFSC has been fine tuned, but it has not changed much at the division level for many years. At this point in time the logic behind the organization is unclear or minimal. The issue is, is it worth the cost of changing it (e.g., stress, political backlash), or is there a way to work with it (e.g., matrix programs). A matrix approach works well with a disciplinary organization (e.g., biologists, modelers, chemists, technologists, etc) when program teams draw on the right mix of disciplines from Divisions. However, when Divisions have there own programs as well as participate in matrixed programs, there is likely to be a conflict for resources and priorities. The AFSC has a senior staff member responsible for managing cross-cutting activities to try to address this potential problem.
4. The Alaska Center feels that vessel and aircraft scheduling is too ad hoc. They feel that the NOAA Corps (ship and aircraft operators) is not sensitive enough to customer needs.
5. AFSC feels that marine mammal research permits (a program administered by F/PR in HQ) are an impediment to research.
6. The AFSC portion of FOCI, a joint AFSC/PMEL activity uses 30-40 DAS annually. The total program uses over 200 DAS. FOCI has been running for more than 20 years. Does its performance justify this large commitment of limited DAS? Is this more about cooperation across NOAA than priority research? When will it end so the resources can be used for new innovative research?

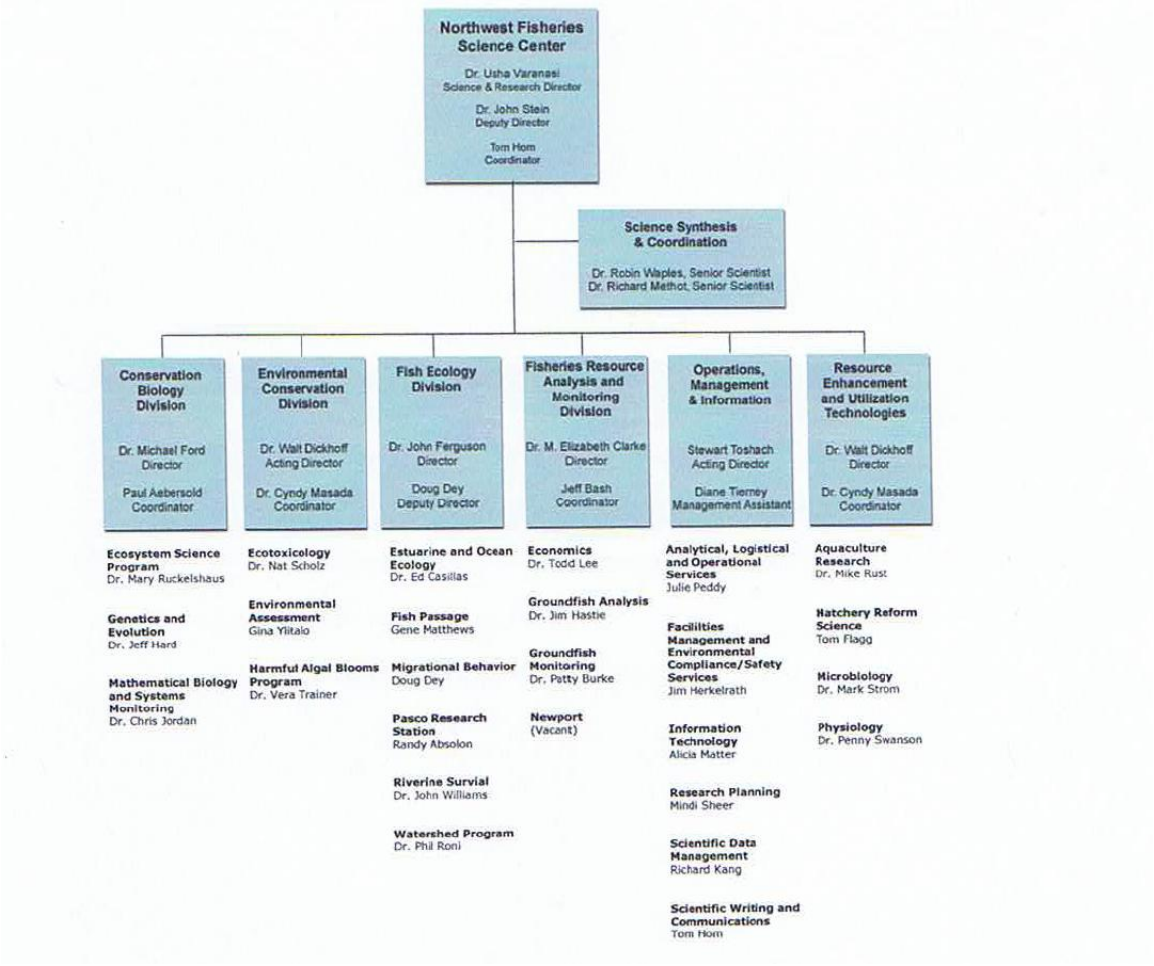
7. The AFSC is significantly dependent on reimbursable funds. For example, more than half of the marine mammal program budget is a reimbursable from the Mineral Management Service.
8. The Marine Mammal program staff felt that the competitive funding program operated by the Protected Species Office in HQ was a useful way of prioritizing, coordinating and peer reviewing research proposals. We discussed the negative side of this funding process (it did not necessarily fit Center priorities). Nevertheless, there were positive aspects from the communication and networking resulting from the program which should be encouraged.
9. It was noted that the AFSC is more dependent on charter vessels for surveys than any of the other Centers. Funding for vessel charters should be viewed as a core (required) cost, not discretionary.
10. We discussed a potential frustrating aspect of program reviews. Will they tell us things we already know, but can't change? On the other hand, they are sometimes necessary to defend or justify changes the leadership has already determined it wants to make.
11. The AFSC is fortunate to have good relationships with U.W. and U. Alaska, as well as PMEL.
12. The AFSC has good relationship with the RO, North Pacific Fisheries Management Council and the fishing industry. The relationship with other stakeholders is unclear (we had no evidence either way).

NORTHWEST FISHERIES SCIENCE CENTER

Organization and programs

The Northwest Fisheries Science Center (NWFSC) is located in a NOAA building at Montlake, Seattle, WA. Additional laboratories are located at Pasco, WA; Mukiteo, WA; Manchester, WA; Point Adams (Hammond), OR; and Newport, OR (at the University of Oregon Hatfield Marine Science Center). The NWFSC has a 2010 budget of $74.2 million (35% of which is reimbursable), and 358 federal employees and 112 contract staff (including post doctoral researchers).

The NWFSC is organized into 6 Divisions as indicated in the following organization chart:



The division organization can be reasonably mapped into the Agencies primary mission areas. Endangered salmon are the primary protected species of the Northwest region and the Conservation Biology Division and the Fisheries Ecology Division primarily support the Agency's protected species mission. The Environmental Conservation Division supports the Agency's habitat conservation mission. The Fisheries Resource Analysis and Monitoring Division supports management of West Coast groundfish (sustainable

fisheries mission). The Resources Enhancement and Utilization Technology Division maintains multipurpose expertise and capabilities that support both primary missions (hatchery technology to enhance critically endangered salmon populations, such as Redfish Lake Sockeye) and secondary missions (aquaculture, seafood safety- referred to as secondary because the Agency's apparent interest in these topics varies over time). The sixth Division provides management support.

Scientific activities of the NWFSC are summarized as follows:

1. Research to support recovery of salmon and steelhead populations of the Northwest region (27 out of 52 evolutionarily significant units, ESUs, are listed under the Endangered Species Act, ESA) including
    a. characterization of population structure among and within ESUs.
    b. developing biological viability criteria for populations and ESUs.
    c. evaluating of current population status.
    d. reviewing and evaluating proposed recovery actions and strategies.
    e. estimating population responses to recovery actions
    f. modeling cumulative risk to estimate the effect of hydropower actions, hatchery impacts, habitat improvements and changes in harvest regimes on the long-term persistence and status of these species.
2. Habitat restoration including:
    a. evaluating the effect removing passage barriers, such as the Elwha River dams and barriers in the Cedar River watershed.
    b. assessing the impact of ongoing restoration activities such as dike removal, riparian plantings and log-jam placement on both habitat conditions and salmonid abundance and productivity.
    c. developing monitoring programs to track changes in the environment and salmon populations.
    d. evaluating the potential for habitat improvement across landscapes such as the Columbia River Basin.
3. Research on estuarine and early ocean survival of salmon including:
    a. evaluating associations between large-scale climatic factors such as the El Nino Southern Oscillation and Pacific Decadal Oscillation and salmonid abundance and productivity
    b. measuring physical and biological metrics in the Columbia River estuary, and linking them to salmonid abundance and productivity.
    c. using physical and biological indicators to predict likely returns of chinook and coho salmon
    d. measurements of physical and biological metrics in the Columbia River estuary, and linking them to salmon abundance and productivity.
4. Research on climate change and recovery of endangered salmon populations including:

    a. impacts of increases in temperature and changes in summer freshwater flow
    b. identification of populations and habitats on various spatial scales that are most vulnerable
    c. evaluation of the efficacy of habitat restoration actions in the face of climate change
5. Research on climate change and ocean productivity including:
    a. studies of zooplankton ecology and monitoring of the California Current off Washington and Oregon
    b. ecosystem modeling and analyses applying statistical forecast models to predict salmon adult run sizes, process models to test understanding of ecosystem responses, biophysical models to relate plankton production to ocean circulations and full ecosystem models to track the ecological interactions from phytoplankton up to top predators (such as sharks, sea birds, and marine mammals).
6. Groundfish surveys to provide information about distribution, abundance, and age structure of groundfish populations. The groundfish surveys are conducted on both NOAA survey vessels and commercial fishing vessels. In addition new survey methods are being developed for non-extractive surveys of groundfish in sensitive areas, to allow a comprehensive look at habitat and fish abundance without damaging bottom habitats.
7. At sea observers of fishing operations (coast-wide) to monitor and record catch and collect critical biological data such as fish length, sex, weight, and age.
8. Benthic habitat mapping and development of fishing gear to reduce habitat impacts.
9. Stock assessments for a growing number of species including stock assessments for canary, yelloweye, cabezon, splitnose, greenstriped and darkblotched rockfish, Pacific hake, Ocean perch, lingcod, and petrale sole.
10. Social and economic assessments to help determine the economic impacts of proposed management actions on various constituent groups, including:
    a. cost-earnings data are collected on a voluntary basis from the commercial vessels and charter boat operators
    b. valuation studies of recreational fishing are conducted.
11. Investigations of non-indigenous species (NIS) invasions including:
    a. forecasting range expansion of European green crab along coastal North America.
    b. identifying origins of invasive tunicates in the Puget Sound basin using molecular genetic techniques.
    c. quantifying changes in ecosystem productivity, community structure and food web dynamics as a result of NIS invasions in several estuaries of the Northeast Pacific using stable isotope analysis.

d. evaluating the effects of NIS such as brook trout on threatened and endangered species including salmon.
e. examining the association between large-scale ocean conditions, such as the Pacific Decadal Oscillation, and the dispersal and population dynamics of invasive cordgrass (Spartina alterniflora) in Willapa Bay.
f. compiling comprehensive databases of aquatic and terrestrial NIS occurrence in the Pacific Northwest.

12. Pollution research including:
    a. identifying the magnitude of toxic input from non-point sources of runoff in urban and agricultural watersheds and the effect of that input on Pacific salmonids and other species of concern.
    b. characterizing the lingering impacts of legacy pollutants, such as those at Superfund sites, and describing the response to restoration and mitigation at those sites.
    c. identifying the effects of natural disasters such as Hurricane Katrina on seafood safety.
    d. describing the distribution and effects of contaminants of emerging concern such as pharmaceuticals in wastewater and fire retardants such as PBDEs.
    e. investigations of the impacts of oil spills and the effectiveness of clean-ups. The NWFSC has conduct assessments after major oil spills such as the Exxon Valdez oil spill, the first Gulf War, and the North Cape and Prestige oil spills, Deepwater Horizon spill in the Gulf of Mexico. Recent advances in molecular and cellular biology have yielded new research tools that are significantly improving our ability to detect oil-induced biological injury following spill events. The NWFSC is examining the toxicological impacts of different types of oil (e.g. fuel oil vs. bunker oil) on imperiled species and on food species.
13. Synthesis of information on the health of Puget Sound as members of the Puget Sound Partnership including:
    a. a comprehensive description of the Puget Sound climatic and physical processes, marine habitats, marine food webs and impacts of future ecosystem change.
    b. identification of indicators of degradation such as disrupted food webs, diminishing habitats, and persistent and toxic contaminants identification of prevention strategies
    c. conducting integrated ecosystem assessment (IEA) by identifying indicators of ecosystem function, assessing risk to those indicators individually and collectively, evaluating management strategies to address risks, assessing performance through a monitoring and evaluation plan, and identifing adaptation strategies as needed.

d. valuation of ecosystem services by developing quantitative models estimating how changes in nearshore systems result in changes in the services provided.
e. Evaluating recovery strategies for endangered and threatened species (Orca whales and three species of salmonids–Puget Sound Chinook, Hood Canal summer chum, and Puget Sound steelhead) by understanding the factors limiting recovery of these species.
f. Evaluating the impacts of freshwater restoration strategies (e.g., dam removal, floodplain channel improvements) on salmon and their habitats

14. Research on Southern Resident Killer Whales (listed as endangered in 2005) including:
    a. monitoring the winter distribution of the population (which in not well known) using a mixture land-based sighting networks, coastal cruises, and passive acoustics to greatly expand observation of the whales on the outer Pacific coast.
    b. Studies of prey preference, energy requirements and the impact of a decline in Chinook salmon which appear to be the preferred prey.
15. Research on environmental impacts of aquaculture including:
    a. the use of forage fish for protein and oil components of feeds
    b. genetic impacts of escapes on wild stocks of the same species
    c. ecological impacts of escapes on natural ecosystems including competition
    d. transfer of disease and parasites to natural populations
    e. pollution from wastes and overfeeding
    f. environmentally friendly culture systems have been developed, e.g., submersible cages
    g. preparation of site location and monitoring guidelines are being adopted internationally
16. Investigations of toxicant and pathological ocean-linked impacts to human health
    a. Characterizing the distribution, frequency and intensity of HABs with respect to climate conditions and changes in climate
    b. Assessing the mechanisms of effect of HAB toxins
    c. Developing rapid assessment methods for HABs and other toxins
    d. Evaluating the distribution and transmission of pathogens responsible for paralytic shellfish poisoning.

Quality assurance

The NWFSC does not have a program review policy. However, there was comprehensive series of review of the entire Center during the period 2003-2005. A unique aspect of the program review process was the use of a consistent protocol and the same chair for all the reviews, thus enhancing the potential for identifying opportunities for synergy and problems of redundancy between program areas. The chair also helped to design the review process. Reviews of the following program areas were conducted:

1. Artificial propagation (hatchery science, marine fish enhancement)
2. Estuarine and ocean ecology

3. Recovery planning, watershed and riverine ecosystems
4. Groundfish
5. Biotechnology applications to ecosystem science

In addition to the chair, review panels had 5 members. The chair was the only participant in more than one review. The reviewers were mostly academic scientists, but there were a few scientists employed by other federal agencies and fisheries agencies of other countries. There was one regional NMFS fishery manager, but no other stakeholders. Except on logistic matters, the chair was the main point of contact with the reviewers to minimize potential conflicts of interest.

Approximately one month prior to each review, panel members were sent background materials consisting of general Center background information, selected CV's of senior staff involved in the review, and pertinent research plans. During each review, panel members received complete briefing folders that contained hard copies of each presentation, complete CVs, lists of publications, and any other materials that were thought to be informative of the program being reviewed.

Each review lasted 2-half days and 1 full day, or 2 days total. During each review, Center staff presented research plans and overall objectives of their programs. Presentations generally lasted 45-90 minutes with ample time set aside for the review panel to ask questions and provide comments. The formal presentation phase lasted a day and a half. During this time, approximately 1 ½ -2 hours were programmed each day for visits to laboratories and for panel members to have one-on-one discussions with all staff involved in the program. There were also two evening sessions where panel members either met with constituents to get their input into the quality and relevance of the research or with staff. On the last day of the review, the Panel prepared a draft report on the strengths and areas for improvement for the program and debriefed senior Center management on the review prior to their departure. Most reviews were conducted off-site at a nearby hotel with meeting rooms to minimize disturbance to the participants. Visits to the Center were arranged when appropriate to view office and lab spaces as well as for discussions with staff.

Each program review panel prepared a written report and submitted it to the Center within approximately 30 days after the program review. Senior managers for each program review shared the review with their staff and prepared a response to the panel reviewers' comments within a set amount of time (generally 4 weeks).

Following the reviews, program modifications were made in response to recommendations. Of course not all recommendations were practical to implement, and some were deemed inappropriate, but overall the NWFSC feels positive about the review process and it believes the reviews had a positive impact. During our visit to the NWFSC, there was talk of repeating the process.

The NWFSC uses Stock Assessment Review (STAR) panels for quality assurance of stock assessments that support fisheries management. The Panels function under the auspice of the Pacific Fisheries Management Council. The priority for stock assessments is decided in consultation with the PFMC and the Northwest Regional Office. Most stock assessments are conducted by NWFSC scientists or scientists from the Southwest Fisheries Science Center (SWFSC). About 20 stocks are assesses mostly every other year. STAR panels plan to meet 8 times in 2010 for a total of 36 meeting days to review 14 assessments. Some of the meeting time is used for generic topics such as assessment of data poor stocks.
Star panels are composed of academic, state agency and NMFS scientists (not associated with the assessments under review). Each panel has about 5 members. The Chair is appointed by the PFMC SSC. At least two members of the Panel are from the Center for Independent Experts (CIE). NMFS stock assessments are reviewed internally prior to being submitted to STAR panels. Assessments accepted by STAR panels are submitted to the PFMC's Scientific and Statistics Committee (SSC) for final approval. Seven of the 17 members of the SSC are from the NMFS.
The scientific products that support the Agency's Endangered Species Act (ESA) decisions (listing, recovery plans, biological opinions) on salmon of the Northwest region are reviewed by

- An Independent Science Advisory Board (ISAB) – non-agency (independent) scientists from academia, industry and agencies other than NOAA. The Independent Scientific Advisory Board (ISAB) serves the National Marine Fisheries Service (NOAA Fisheries), Columbia River Indian Tribes, and Northwest Power and Conservation Council by providing independent scientific advice and recommendations regarding scientific issues that relate to the respective agencies' fish and wildlife programs.
- Independent Science Review Board (ISRP) -- The ISRP reviews individual fish and wildlife project proposals for funding by Bonneville Power Administration and makes recommendations on matters related to those projects. NWFSC submits proposals that are reviewed by the ISRP, which has a make-up very similar to the ISAB.
- Recovery Science Review Panel (RSRP) (no longer active) – the RSRP consisted of eminent scientists from around the country with expertise in conservation biology, population biology, fisheries modeling and other relevant fields. This group provided regular advice and input into scientific products being developed by the Technical Recovery Teams.
- Technical Recovery Teams (TRTs), comprised of NOAA, academic, state, tribal, federal and other scientists, that
    - characterize population structure within ESUs
    - developing biological viability criteria for populations and ESUs
    - evaluate of current population status.
    - review and evaluate proposed recovery actions and strategies.

- Recovery Implementation Science Teams (RIST), also a multi-agency, multi-disciplinary science group, that provide scientific support for implementing these recovery plans.

Similar review processes are used for the NWFSC's scientific input to ESA decisions on the Southern Residence Killer Whales.

Another type of scientific product of the NWFSC is scientific publications. The NWFSC has averaged 121 external (non-Center) publications during 2000-2009 (e.g., journals, technical reports, books or book chapters subjected to non-AFSC peer review). The NWFSC publication policy requires these products to be internally reviewed before they are submitted for publication.

Program management

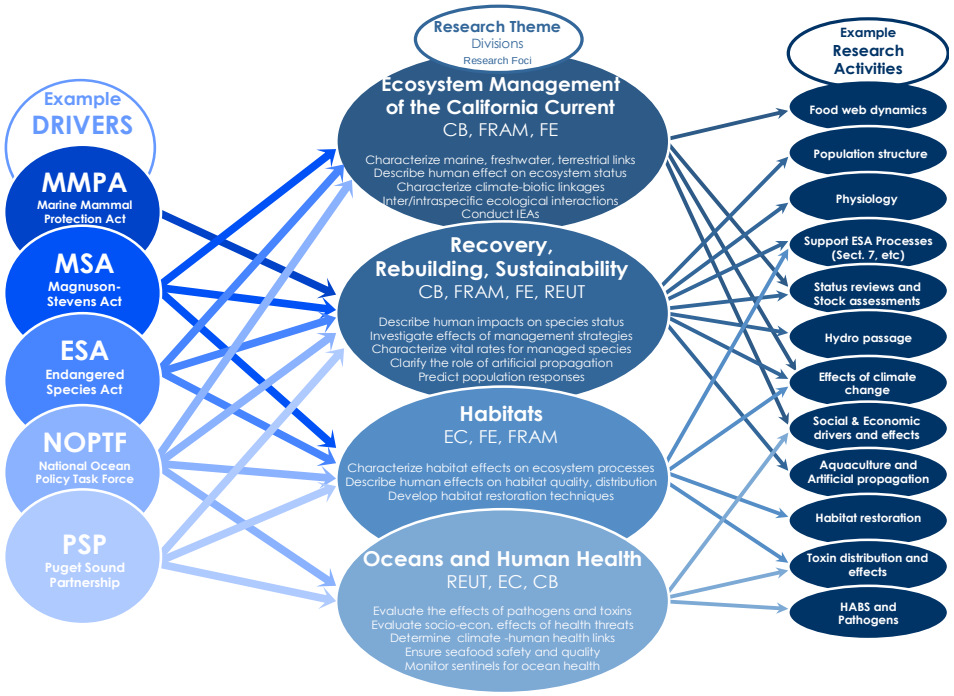
The NWFSC adopted a Science and Research Plan in 2008. The Plan was designed to respond to important drivers of NMFS research (e.g., requirement of legislative mandates). It has four broad research themes as follows:

- Ecosystem-based Management for the California Current Large Marine Ecosystem
- Recovery, Rebuilding, and Sustainability of Marine and Anadromous Species
- Habitats to Support Sustainable Fisheries and Recovered Populations
- Oceans and Human Health

These broad themes are fulfilled by pursuing seven near term priorities as follows:

- Integrated Ecosystem Assessment (IEA) of Puget Sound
- In-stream flows effects on salmon and people under climate change
- Alternative methods for groundfish surveys
- Prediction of population and higher-level response to impacts across the life-cycle of species of concern
- Rapid detection and prediction of marine impacts to human health
- Initiation of an ecosystem-based aquaculture research program
- Ocean acidification research

The relationship between drivers, themes, short term priorities and research activities to fulfill the Plan is illustrated in the figure below:



Management responsibility for the Plan is shared by the NWFSC Research Council (comprised of 13 rotating members including scientists and some Division Directors) and the Executive Council (Science Director, Deputy Director and Director of Operations, Management and Information). The Research Council makes recommendations for new research based on a fiscal planning target from the Executive Council. Recommendations approved by the Executive Council are funded and implemented. Progress reports have been prepared for the near term priorities and the Plan is to be updated in 2010 based these reports.

The NWFSC developed a project data base to aid in program management. It is a relational data base that can be searched and manipulated to prepare custom reports (e.g., what activities, people, budget tasks support a particular Plan theme?).

Other observations

1. The NWFSC has set aside a small amount of funding that scientists can compete for to conduct innovative research. This small amount of funding stimulates a lot of creative thinking by the staff.
2. The NWFSC benefits from a strong relationship with the University of Washington and Oregon State University.
3. When the Center was formed from remnants of Northwest and Alaska Fisheries Science Center about two decades ago its mission was relatively low priority in the Agency. It also had an aging staff. It was heavily dependent on reimbursable funds (about 70%). Since then, the Center has been reinvented. It now has exciting young

scientists, and its dependence on reimbursable funds has been reduced to a level (30%) that is probably typical or better than other Centers. Does this demonstrate that real change occurs when the situation is so desperate that the status quo is no longer an options? It is also evidence of the importance of leadership (with authentic scientific credentials, strong commitment to mentoring, and the tenacity to fight for programs).

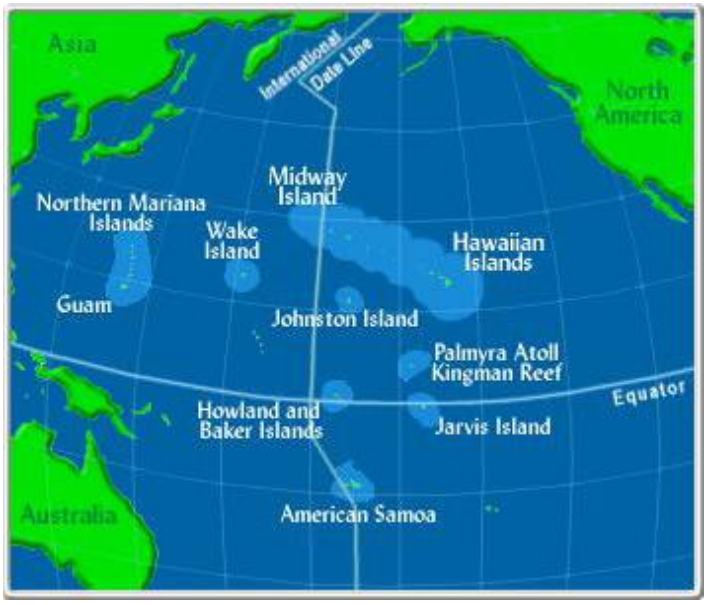
4. Discussions at the NWRO confirmed that the Center and the RO have a good working relationship. The Regional Administrator was very positive. He felt that the review processes of ESA science worked well, indeed, they are essential.
5. We discussed the potential value of some sort of sabbatical program for scientists. The NOAA career development program doesn't seem to work well for scientists.
6. The Science Director of the NWFSC has develop operating agreements between the NWFSC and SWFSC (she's been the acting Director of the latter), and the SWFSC and the Pacific Islands Fisheries Science Center (PIFSC, which had been part of the SWFSC). These comprehensive agreements may be a useful model of cross Center cooperation throughout the Country. This will be important if it is decided that some Center should provide scientific support beyond their region. It is also important for activities that are inherently coast wide (e.g., Pacific groundfish management).
7. The NWFSC conducts a Center Science Symposium every two years. This is a good opportunity for young scientists to gain experience giving a paper. It is also informative and conducive to network building.
8. Ocean acidification was added as a seven near term priority because of the National priority given by NOAA and NMFS HQ. This is indicative of the difficulty of planning at the regional level when National priorities change in an unpredictable manner.
9. Economists and social scientists of the NWFSC are distributed throughout the organization instead of being in a single organization unit. This may help integrate the human dimension into all of the work of the Center, but does it leave the economist and social scientists at sub-critical mass in terms of nurturing each other professionally? The NWFSC does not think this is a problem because they are well networked with each other.
10. The Center complained about frequent data calls, administrative requirements and apparent crisis management mode of HQ.

PACIFIC ISLANDS FISHERIES SCIENCE CENTER

Organization and programs

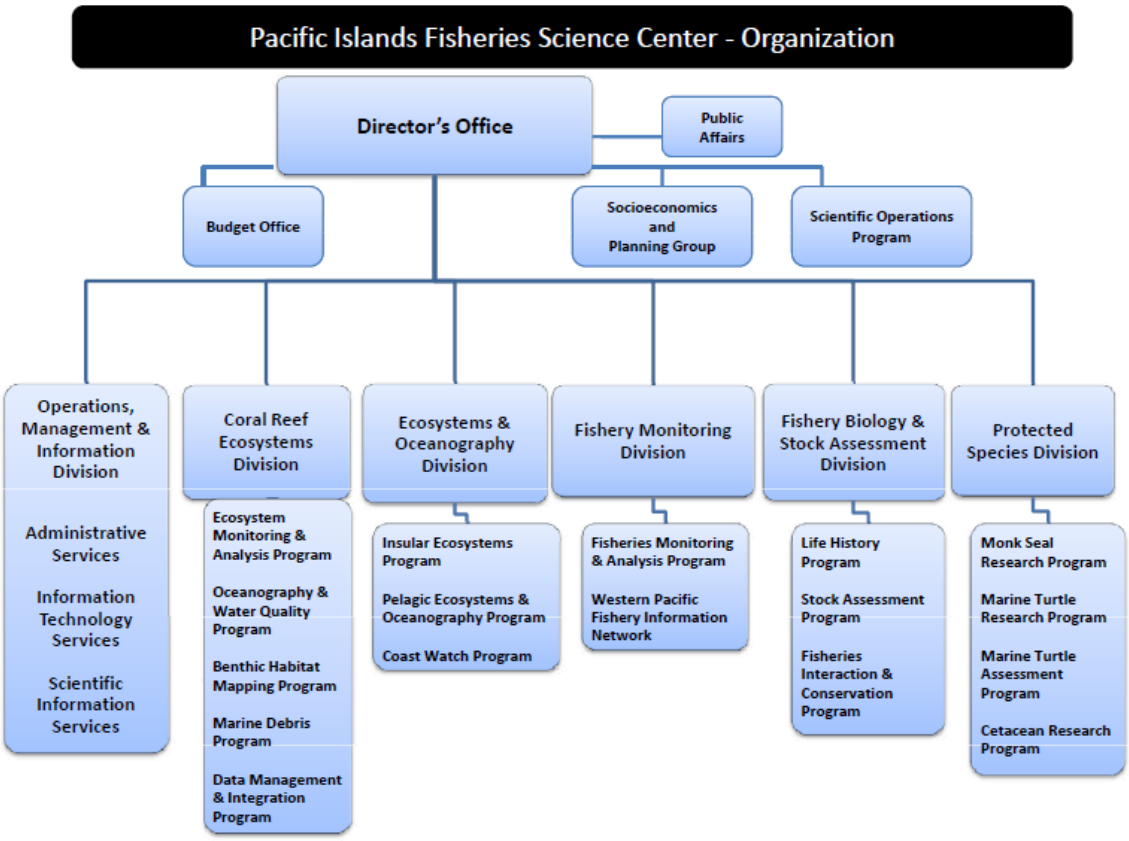
The Pacific Islands Fisheries Science Center is currently located adjacent to the University of Hawaii campus. It also has facilities at several other sites around Honolulu including a wet laboratory at the Aiea Heights Research Facility, a small circulating seawater facility dockside at Kewalo Basin, a small boat facility at Snug Harbor, storage at the Kakaako Warehouse, and offices in the Kapiolani Blvd. Office Building with the Pacific Islands Regional Office (PICO). A NOAA Regional Center is being constructed at Ford Island (Pearl Harbor). The PIFSC will begin relocating to the Ford Island complex in the near future and is scheduled to be completed by the end of 2013.

The PIFSC has responsibility for marine ecosystems around several US territories of the Pacific region, as well as the main Hawaiian Islands and the Northwest Hawaiian Islands (see the map below). It is a vast area with diverse cultures.



The 2010 budget of the PIFSC is $29.3 million comprised of 9M of base funds (with minimal restrictions), 7M of funds annually allocated by NMFS (the degree of restrictions on how the funds are spent varies), 5.3M of NOAA Coral Reef Conservation funds, and 9.7M of Congressionally directed funds including “pass-through” grants. About half of the budget is subject to year to year budget allocation/appropriation decisions that are “risky” from the Center’s perspective. As a result, the staff is less than 50% federal employees (97 Federal, 105 Non-Federal).

The PIFSC is organized as follows:



There are five research divisions with 17 branches. The Fisheries Biology and Assessment Division and the Fisheries Monitoring Division largely support the Agency's Sustainable Fisheries mission (Magnuson-Stevens Fisheries Conservation and Management Act), and the Protected Species Division supports the Agency's Protected Species mission (Marine Mammal Protection Act and Endangered Species Act). The Ecosystem and Oceanography Division supports both missions by conducting research to take account of environmental and ecological factors in the dynamics of fishery resources and protected species. The Coral Reefs Ecology Division supports the Agency's Habitat Conservation mission and the Coral Reef Conservation Act of 2000.

The scientific activities of the PIFSC are summarized as follows:

1. Monitoring of oceanography conditions and water-quality of coral ecosystems using in situ observations collected from ships, small boats; surface and subsurface moored instrument arrays, satellite tracked drifters, satellite borne remote sensors, and model output.
2. Development of tools and instruments to improve Integrated Ecosystem Assessment of coral reef ecosystems including ecological acoustic recorders (EAR), bottom camera bait stations for relative abundance and composition of bottomfish.
3. Coral reef ecosystem monitoring and analysis to document spatial distribution, density species composition, size structure and composition of corals, other invertebrates, fish and algae during biennial surveys and site specific rapid ecological assessments using the following methods:
    a. roving diver surveys, towed divers, belt transects, photoquadrats, video transects, and specimen collections,
    b. Ecological acoustic recorders,
    c. Autonomous reef monitoring structures (ARMS).
4. Benthic habitat mapping to describe the depth, character and composition of the seafloor and associated biota in and around coral reefs.
5. Towed-diver, swimmer, and aerial marine debris surveys to assess type, density and distribution and research to better understand the impact of marine debris.
6. Coral reef data management and quality assurance.
7. Ecosystem and oceanographic research on processes and relationships with habitat function and population dynamics of resource species including:
    a. investigation of insular habitat and ecology to understand the processes regulating the population dynamics of island-associated species,
    b. investigation of pelagic habitat and ecology to understand the affect of oceanographic conditions on large pelagic species,
    c. investigation of oceanographic research as input to stock assessments, to develop indicators of ecosystem changes,
    d. at sea data collection from ships, deep diving submersibles, remotely operated vehicles, and scuba,
    e. application of advanced technology such as pop-up satellite archival tags, animal-borne instruments (“crittercam”)
    f. satellite remote sensing, and
    g. ocean circulation modeling and ecosystem modeling (e.g., ECOPATH model of carrying capacity of French Frigate Shoal relative to Hawaiian monk seal).
8. Cooperative fisheries statistics collection in American Samoa, Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawaii by the Western Pacific Fisheries Information Network (WPacFIN) including coordination, technical assistance and development and distribution of software tools.

9. Collection, processing and reporting on federally mandated longline logbook program.
10. Outreach with the recreational and commercial fisheries to foster conservation (such as use of barbless circle hooks to reduce interactions with sea turtles and monk seals).
11. Economic data collection and analyses to assess economic health and capacity of fishing fleets, vessel costs and earnings, fish prices and markets, impacts of regulations, evaluation of direct use and indirect use values of living marine resources.
12. Investigations of the human dimension of fisheries and other uses of marine ecosystems by exploring social and cultural benefits and associated values of marine resources. Also investigates the role that institutions and traditional marine use practices can play in ensuring sustainable use and conservation in the current socioeconomic context.
13. Research to minimize incidental capture of sea turtles and other bycatch species in pelagic longline and other fisheries, including
    a. modifications to fishing gear and bait,
    b. promoting adoption of such methods through outreach and education programs,
    c. research on post-release survivorship of fishes, sharks and sea turtles released from pelagic fishing gear,
14. Modeling the effects of various factors on the vulnerability of pelagic fishes to capture in longline and other fisheries and to use the results in standardizing catch-per-unit-effort(CPUE) data for pelagic stock assessments.
15. Investigations of the age, growth, and reproductive strategies of managed fish species and bycatch species, including coral reef fish species, community structure and population responses to anthropogenic factors.
16. Population assessments of
    a. pelagic species including yellowfin and bigeye tuna in the western and central Pacific Ocean,
    b. albacore in the South Pacific Ocean,
    c. swordfish, striped marlin and blue shark in the North Pacific Ocean,
    d. insular species including bottomfish in the Hawaiian Archipelago, Gaum, and Mariana Archipelago,
    e. lobster in the Northwest Hawaiian Islands,
    f. Incidental take of sea turtles, seabirds, marine mammals, bycatch (mostly sharks) in the Hawaiian longline fishery.
17. Investigation (throughout the Hawaiian Islands) of monk seal population dynamics and the factors that affect recovery, including:
    a. annual census of abundance and other field studies to determine population and demographic trends,
    b. studies of foraging ecology,

c. monitoring of health and diseases,
d. identification of natural and human factors that may be limiting monk seal recovery; and
e. research on methods to enhance recovery of the species.

18. Studies of populations of whales and dolphins in the central and western Pacific Ocean including:
    a. surveys of cetacean distribution, abundance and stock structure;
    b. studies of habitat use, reproduction, and mortality; and
    c. assessment of natural and anthropogenic threats to cetacean populations.
    d. Use of ship-based visual and acoustic line transect surveys, photo identification studies, passive acoustic surveys using High-Frequency Acoustic Recording Packages (HARPs), habitat modeling, and ecosystem studies.
19. Studies of the threatened Hawaii green sea turtle populations including:
    a. field studies of growth rates, mortality, and movements,
    b. long-term monitoring of abundance trends via an annual surveys of the primary nesting colony at East Island, French Frigate Shoals, in the NWHI,
    c. and the biology, etiology, and effects of fibropapilloma disease, and
    d. training of Pacific islanders and fishery observers in sea turtle biology and handling, collects data on fishery interactions with sea turtles.
20. Investigation of the pelagic ecology of loggerhead turtles.
21. Studies of sea turtles in the US territories outside of the Hawaiian Islands including:
    a. Assessment of status, population trends, ecology, and stock structure,
    b. development of skeletochronology techniques for age determinations,
    c. development of statistical simulation models, and
    d. evaluation of management strategies for recovery of sea turtles of the Pacific Ocean.
    e. assessment of natural and anthropogenic impacts.

Quality assurance

The Pacific Islands Fisheries Science Center (PIFSC) does not have a written program review policy. However, it has a long history of annual program reviews conducted by the Southwest Fisheries Science Center (which included the Honolulu Laboratory until less than 10 years ago) as part of the SWFSC's annual program planning and budget allocation process. All scientific activities were reviewed on a Laboratory or Division by Division basis. These were mostly internal reviews, although Headquarters staff often observed, and in some cases, there was limited participation of external scientists and/or stakeholders.

Since established as an independent science center, the PIFSC has conducted an annual external program review of a selected topic or program as follows:

- Center Organization- 2007
- Ecosystem Science- 2008
- Research on Pelagic Resources- 2009
- Scientific Data Management and Capabilities- 2010

These reviews are of broad program areas that cross cut the Center organization. They were conducted by a panel of experts during a three day site visits. The external reviewers were invited by the Center Directorate. They were from universities and state and federal agencies. In some cases, reviewers were from elsewhere in NMFS.

In addition to reviews of broad program areas, the PIFSC uses the Center for Independent Experts (CIE) to conduct focused reviews of specific topics. In recent years, these have included:

- Larval transport modeling
- Socio-economic analyses of bycatch reduction
- Green turtle research program
- Acoustics program
- North Pacific swordfish assessment
- Impact of potential increase in Hawaiian shallow set longline fishing effort on sea turtles
- SPC's Oceanic Fisheries Program bigeye and yellowfin tuna stock assessments
- PIFSC bottomfish assessment

In general, the PIFSC thinks that CIE reviews are useful, but finds that when appropriate a consensus report can be more useful than reports from individual reviewers. Individual reports may be prepared because of restrictions placed on program reviews by the Federal Advisory Council Act (FACA).

Program review reports are posted on the PIFSC website along with comments and responses from the Center.

The PIFSC and its staff seem to be generally pleased with these recent reviews. Reviewer reports were constructive with several or many useful suggestions. The Center seems serious about responding positively to the reviews. Although the topic has not yet been selected for an upcoming review, the practice of annual external reviews of a major program area will continue.

Product quality assurance of stock assessments used as the basis for fisheries management advice is provided by the Western Pacific Stock Assessment Review (WPSAR) process , international scientific committees, and reviews by the Center for Independent Experts.

The WPSAR was recently established by the PIFSC, PIRO (Pacific Islands Regional Office), and WPRFMC (Western Pacific Regional Fishery Management Council). The process is

similar to the STAR process of the Pacific Fishery Management Council. Priorities are set by a steering committee of the PIFSC, PIRO and WPAC. WPSAR reviews are conducted under the auspices of the Scientific and Statistical Committee of the WPAC (thus exempting them from FACA). WPSAR panels are chaired by an SSC member, and the panels are to be composed of additional SSC members and independent (non-PIFSC) scientists including scientists assigned by the CIE. There are 5 panel members and a chair. WPSAR panels report to the SSC, which then makes recommendations to the Council.

Only one WPSAR review has been conducted so far (Hawaii deep slope bottomfish in June 2009). The review was favorable about the assessment model developed by the PIFSC, but it expressed concern about documentation of methods used to process input data. As a result, the WSPAC SSC conducted its own analysis to support advice to the Council. This first not entirely satisfactory experience with the WPSAR process might reflect growing pains (the PIFSC expected the focus of the review to be the model, not input data). The WPSAR panel was unable to complete their review in 2010 due to absence of international participation.

PIFSC scientists also participate in stock assessment processes of the International Scientific Committee (ISC, and informal arrangement among tuna fishing nations of the Pacific) and the Scientific Committee of the Western Central Pacific Fisheries Commission (WCPFC). These scientific bodies provide review and advice regarding international stock assessments of tunas and swordfish.

Marine mammal assessments conducted by the PIFSC are subject to review by either the Pacific Scientific Review Group established by the MMPA or the Scientific Committee of the International Whaling Commission (IWC). The Center conducts assessments for the Hawaiian monk seal (listed as Endangered), shares assessment responsibility for cetaceans with the SWFSC, and led the insular Hawaiian false killer whale Biological Review Team; this stock was recently subject to an ESA listing petition.

The PIFSC and the PIRO have agreed to a protocol for ESA listing status reviews. Scientific input to listing decisions is considered by a Biological Review Team (BRT) established in accordance with the protocol. The BRT is chaired by a PIFSC scientists and all of its members (preferably a minimum of 3) are federal employees as required by FACA. However, the BRT may establish panels of non-federal scientists to provide scientific input to the process. The protocol calls for anonymous independent peer reviews of the BRT report before it is finalized and submitted to the PIRO as the scientific input to a listing decision. A comparable process is used for ESA listing status reviews of species found in multiple regions (e.g., 83 species of corals currently under review).

In addition to BRTs, scientists participate in Recovery Plan Teams and Recovery Plan Implementation Teams and they are called on for input to jeopardy decisions, but scientific input from the PISFC is ad hoc. When scientific input is deemed important, the

Center prepares Information Reports (IRs) to document the input. IRs are subjected to the Center's internal review process described below.

The PIFSC has a Scientific Information Service (SIS) led by a senior scientist with decades of research experience. The Service tracks and archives all written documents produced by the Center (including IRs). Internal peer review is required before documents are sent to the Center Directorate for final approval. In some cases, the head of SIS may require external peer review.

In 2009, the PIFSC scientists had about 55 external (non-Center) peer reviewed publications.

Program management

The PIFSC Director characterizes management as decentralized with authority delegated to Division Chiefs to manage their resources to achieve annual operating plan milestones. The milestones are tracked in the Agency's Electronic Annual Operating Plan (eAOP) system. Milestones are primarily identified by the Divisions, but they are negotiated with the Center Director, and they reflect external input from program reviews, Headquarters, WPAC and PIRO. The PIFSC has 78 milestones, although only a few of them are tracked by HQ.

The PIFSC Director and the PIRO Administrator meet monthly to plan and coordinate activities. Division chiefs also meet routinely. The PIFSC and the PIRO have a joint strategic plan for the period 2005-2010 which was co-authored by the WPAC. The plan has eleven goals as follows:

1. Implement conservation and management measures based on ecosystem principles and scientific research
2. Conserve and enhance recovery of *protected marine species*
3. Conserve and manage *fisheries* using science-based management and, as appropriate, traditional and community-based management approaches
4. Conserve, protect and restore marine *habitat* and coastal ecosystems
5. Support *international* cooperation in the conservation and management of pelagic ecosystems
6. Maximize the quality, accessibility and timeliness of *information* in support of sustainable marine ecosystem management
7. Integrate *social, economic and cultural* information and understanding of traditional knowledge and practice into sustainable marine ecosystem management
8. Expand support and education concerning good *stewardship* of sustainable marine ecosystems
9. Support successful conservation and management of living marine resources through effective *enforcement* strategies

10. Integrate the requirements of the National Environmental Policy Act (*NEPA*) into sustainable marine ecosystem management
11. Provide appropriate and effective staffing and *administrative support* for sustainable marine ecosystem management

Each of the goals is supported by 2-6 objectives. However, the PIFSC acknowledges that the regions Strategic Plan does not play an important role in current management of the Center. They mentioned that it should probably be revised and updated as the period it covers has past.

Other observations

1. The Center provided data such as biweekly time-sheets that categorized research staff activities as part of the accreditation exercise. The data was reviewed by the Science Board and Center leadership. After completion of the exercise, the Science Board agreed to terminate the data collection process.
2. The PIFSC commented on an integrated priorities list it prepares and submits to HQ for consideration in the annual budgeting process. However PIFSC has not found the integrated priority list process effective in obtaining any additional funding.
3. The Center Director indicated that the staff may have difficulty distinguish between science and management. He has established a policy to make clear that they are separate.
4. Coral reef program has annual symposium with non-federal partners. This provides ongoing feedback.
5. PIFSC still has some minor involvement with the IATTC.
6. PIFSC is concerned about how the Pacific SRG input on agency science should be viewed. It is unclear how binding scientific views of a SRG are.
7. The PIFSC shares a congressional directive for turtle-related work with the PIRO. Our impression is that some of the activities conducted by the PIRO on turtles are scientific, and they need to be included in program reviews of scientific activities.
8. WPAC was critical of preparation for the review of deep slope bottom fish. They were also concerned about data collection. The WPAC had a data workshop which identified a lot of gaps and problem areas. WPAC had prepared a detail memo to the PIFSC and PIRO outlining problems and soliciting a response. This is a long standing problem.
9. WPAC wants the PIFSC to use more of its research vessel assets for fisheries independent data collection. They disagree with current priorities for research vessels.
10. Mike Sissenwine met with PIRO and the Western Pacific Regional Fishery Management Council upon the recommendation of Center Director, Sam Pooley.

SOUTHWEST FISHERIES SCIENCE CENTER

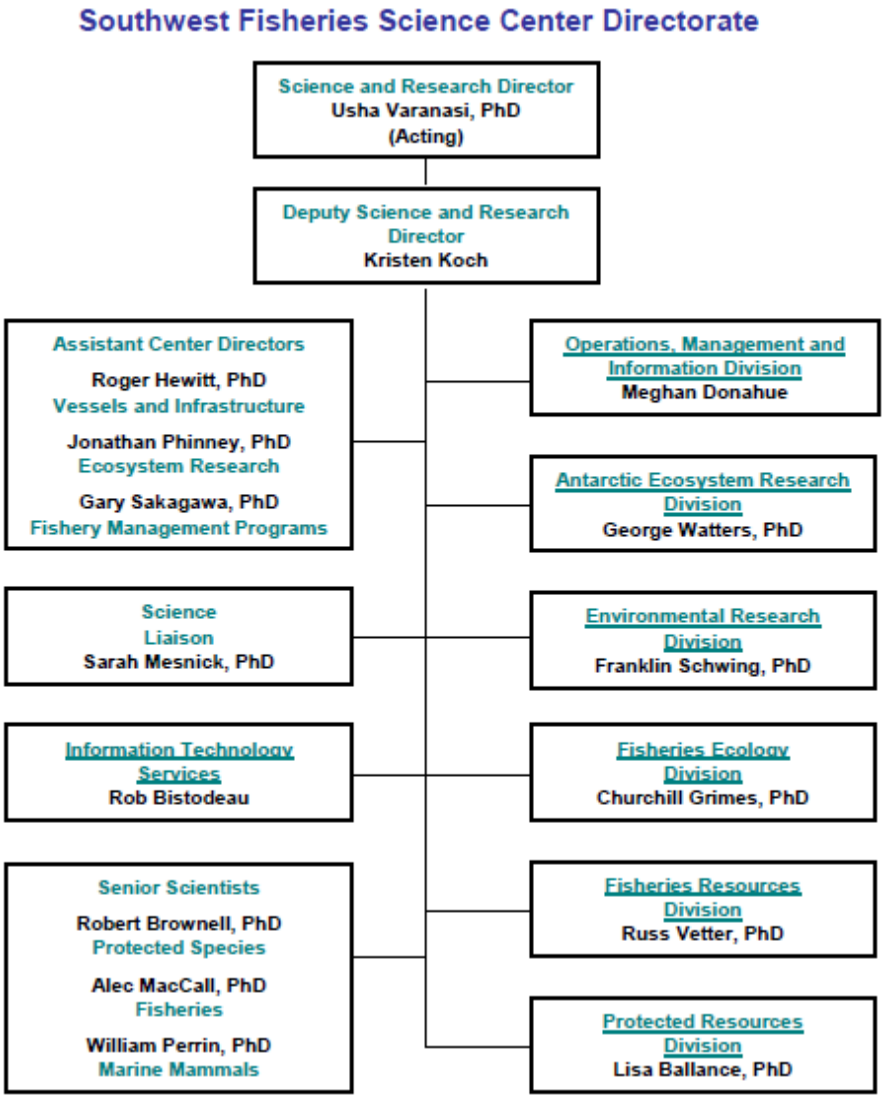
Organization and programs

The Southwest Fisheries Center (SWFSC) Headquarters is located on the University of California San Diego campus with the Scripps Institution of Oceanography. Recently, it partially re-located to a new building because part of the building where it had been located was determined to be unsafe as a result of cliff erosion. The SWFSC also has a relatively new laboratory on the University of California Santa Cruz campus (which replaced the former Tiburon Laboratory). It also has a laboratory in Pacific Groove, CA, near Monterey, in order to continue its long term association with the Navy Fleet Numerical Meteorology and Oceanography Center. Shore-based field research is conducted from Arcata, CA (CSU-Humboldt), Granite Canyon, CA, Piedras Blancas, CA and on the Antarctic Peninsula. The Inter-American Tropical Tuna Commission, staff from the California Department of Fish and Game, a CoastWatch node, and an office of the Monterey Bay National Marine Sanctuary are located in facilities of the SWFSC.

The geographic purview of the SWFSC is the US EEZ off the coasts of California, Oregon, and Washington, the Southern Ocean around Antarctica, particularly the northern part of the Antarctic peninsula and the eastern tropical Pacific Ocean. It is also involved in research on tuna fisheries and protected species throughout the Pacific Ocean, often in cooperation with the PIFSC and international collaborators.

The 2010 budget of the SWFSC is $50.8 million, including 12.5M of funds transferred on an annual basis (about 25%). The Fisheries Ecology Division participates in several extramurally funded research projects with academic partners at the University of California Santa Cruz which add significantly to its effective budget. These funds do not appear in the SWFSC's budget.

The SWFSC has 272 federal employees, 71 contractors, and 13 post doctoral scientists. It is organized as follows:



There are five research divisions. The Antarctic Ecosystem Research Division is more or less a standalone division (i.e., in terms of geographic area of operations, species, mandates). The geographic area of interest of the other four divisions overlaps in the California Current with the Fisheries Resources Division focusing on large and small pelagic fishery resource species, Fisheries Ecology Division focusing on groundfish and salmon, and Protected Resources Division focusing on marine mammals and sea turtles. The Environmental Research Division provides core physical oceanographic expertise for the Center. All five Divisions conduct research on the relationship between environmental and ecological factors and fishery resources and protected species. The Environmental Research Division is the Agency's remaining core of physical oceanographic expertise. The Fisheries Resources Division and the Protected Resources Division have programs covering larges areas in the Pacific Ocean, including the eastern tropical Pacific Ocean where the interaction between tuna fishing and marine mammals (small cetaceans) has

been the focus for decades. The Fisheries Ecology Division conducts research on benthic habitat that is potentially altered by fishing. It also conducts research in estuaries and spawning rivers of salmon. Both the Fisheries Ecology and Fisheries Resources Divisions conduct economic and social science research and the Protected Resources Division collaborates with the Fisheries Resources Division on this research with a focus on marine turtles.

In light of the overlapping nature of the research activities of the five research divisions, the former Director developed the following matrix to represent the SWFSC's capabilities and programmatic activities:

	RESOURCE MANAGEMENT PROGRAMS:								
	STRATEGIC RESEARCH	ABALONE PROGRAM	COASTAL PELAGIC SPECIES PROGRAM	HIGHLY MIGRATORY SPECIES PROGRAM	CALIFORNIA DEMERSAL SPECIES PROGRAM	ANADROMOUS SPECIES PROGRAM	MARINE MAMMAL PROGRAM	SEA TURTLE PROGRAM	ANTARCTIC ECOSYSTEM OBSERVING PROGRAM
DISCIPLINE PROGRAMS:									
ECOSYSTEM & CLIMATE RESEARCH									
POPULATION ASSESSMENT									
RESOURCE SURVEYS									
BIOLOGY, ECOLOGY & LIFE HISTORY									
ECONOMIC & SOCIAL MONITORING & ASSESSMENT									
DATA MANAGEMENT									
ADMINISTRATION & INFRASTRUCTURE									

However, the Center staff indicate that there wasn't much "buy-in" to the matrix approach, and it does not seem to have much influence on the current management of the Center. This matrix represents the last formal structure under which program reviews took place on a routine basis.

The scientific activities of the SWFSC are summarized as follows:

1. Studies to support conservation and management of California demersal species including:
    a. mid-water trawl survey to collect abundance data on young-of-the-year groundfish, coastal pelagic species, the deep scattering layer and other components of the California Current epipelagic ecosystem.
    b. annual groundfish assessments for PFMC.
    c. develop indices of pre-recruit abundance for several rockfish species for use in groundfish stock assessments.
    d. produce preliminary GIS maps of bottom trawling intensity off California for Deep Sea Coral Research and Technology Program.
    e. produce online database of monitoring of demersal communities inside and outside marine protected areas off central California.

f. conduct socio-economic studies on ecosystem-based fishery management of California commercial fisheries, ports that have maintained higher levels of fishing activity than expected and effects of Pacific groundfish trawl buy-back program.
g. conduct studies examining growth rates of juvenile rockfish, fecundity estimates for rockfish.

2. Research on California coastal pelagic species (fishes and invertebrates) including:
    a. conduct quarterly CalCOFI survey, process samples and produce annual data report.
    b. provide service-oriented architecture for data management that supports the transformation of data into information for a wide variety of users from scientists to managers to the general public.
    c. conduct assessment of coastal pelagic species for the PFMC.
    d. improve efficiency of annual Pacific sardine stock assessment by creating an analytical package to calculate spawning stock biomass using the daily-egg production methods in R-software environment.
    e. conduct study on the trends in the abundance and spatial distribution of mesopelagic fish in relation to climate variability and on the spatial variability of krill as a prey resource along the U.S. West Coast.
    f. conduct bio-economic model of the total economic value of Pacific sardine to an ecosystem and investigate the potential for rights-based management of the domestic Pacific coast coastal pelagic species fishery.
    g. conduct studies on market squid para-larval time series, Pacific sardine spawning biomass, coast-wide Pacific sardine egg production, and population genetic structure for Northern anchovy.
    h. conduct data analysis and identification of archived fish, eggs and para-larvae of Pacific sardine, Pacific mackerel, jack mackerel, cephalopods, and Pacific hake.
3. Highly migratory species research including:
    a. provide stock assessments on HMS to the PFMC and to international regional fishery management organizations
    b. conduct research on North Pacific albacore stock assessment methodology to improve future stock assessments.
    c. archive, process, maintain and provide information from U.S. West Coast HMS fisheries to international regional fishery management organizations and domestic councils; develop data management systems for timely, accurate and automated reporting.
    d. conduct field and analytical studies to identify HMS hotpots in the North Pacific Ocean.
    e. deploy tags on blue sharks to assess their post-release mortality in the California Drift Gillnet fishery
    f. process albacore archival tag data and analyze data to identify albacore core habitats and characterize oceanographic conditions.
    g. continue collection, maintenance and processing of data and samples from local recreational and commercial HMS species
    h. conduct annual recreational angler survey for billfishes and publish results in the Billfish newsletter.
    i. conduct socio-economic studies on technical change and economics of fishing capacity, develop a model of participation in HMS fisheries to test that both macroeconomic conditions and the biological stock drive recreational participation, and develop an economic model to estimate the economic value of HMS recreational fishery's utilization of CPS as bait.

4. Marine mammal research including long time series of at-sea, shore-based and aerial surveys of the California Current and eastern tropical Pacific ecosystems. These include:
    a. periodic (every 3-5 years) ecosystem-based ship-based survey of cetaceans in the California Current; conduct annual gray whale abundance estimates from two shore-based stations.
    b. periodic (every 3-5 years) gray whale population abundance surveys and annual calf production surveys from two shore-based stations.
    c. review of humpback whale status in the north Pacific Ocean and globally.
    d. study to investigate the seasonal and inter-annual movement of blue whales.
    e. study to estimate the relationship between gray whale calf production and Arctic sea ice.
    f. biochemical methods to assess physiological stress in free-ranging cetaceans.
    g. study on contaminant levels in bottlenose dolphins inhabiting the Southern California Bight.
    h. studies to improve large whale stranding response capacity.
    i. studies to define population structure of marine mammals.
    j. study of the ecosystem effects of different purse-seine stet types in the eastern tropical Pacific.
    k. participate in the cetacean Behavioral Response Studies to determine whether Navy sonar is adversely affecting the behavior in the navy operational areas in the Southern California Bight and the AUTEC range in the Bahamas.
    l. develop new genetic markers for population structure analysis of large whales.
5. Research on sea turtles including:
    a. estimate density, abundance and trends of ESA-listed marine turtles by conducting surveys of nesting beaches an foraging areas.
    b. conduct study on leatherback turtles in the Pacific Ocean and identify areas of overlap with fisheries where potential interactions may occur.
    c. elucidate corridors and critical foraging areas of marine turtles with an emphasis on establishing the susceptibility of marine turtles to marine fisheries by-catch.
    d. conduct study to identify basic biological parameters that are necessary for developing accurate stock assessments of marine turtles.
6. Conduct study on the ocean ecology of California Salmonids including:
    a. Evaluate options for assessment of fall ocean salmon fisheries, conduct assessment of Klamath and Sacramento River fall Chinook salmon, and conduct assessment on west coast salmon fishery impacts on ESA listed California salmon stocks for the PFMC.
    b. Deploy a real-time river temperature prediction system with a Web interface for fisheries and water managers to use.
    c. Support inter-agency efforts to analyze benefits and costs of Klamath dam removal by providing salmon production methods and analyses.
    d. Conduct study on the ecology and genetics of steelhead and coho salmon populations in Central California streams, Klamath River Basin, and Central Valley relevant to restoration of ESA listed ESUs.
    e. Determine habitat use and distribution of steelhead and chinook salmon using archival telemetry.
    f. Determine ocean and estuarine ecology of California Chinook salmon.
    g. Determine the ocean distribution of California Chinook salmon stocks using genetic stock identification (GSI), and evaluate the utility of GSI for harvest management.

7. Conduct study on population structure of green sturgeon and migration among estuaries and natal rivers.
8. Conduct first round of acoustic monitor attachments to elephants seals to locate acoustically-tagged species in the northeast Pacific.
9. Ecoystem observations and climate change studies including
    a. Conducting NOAA's longest-time series and largest-scale monitoring surveys in the California Current, Eastern Tropical Pacific and Southern Ocean.
    b. Conducting assessments and predictions of the effects of climate and environmental variability - from global to local scales - that is important to fish populations, protected species, and integrated ecosystems assessment.
    c. Development of web-based access to a wide variety of oceanographic and biological data.
10. Innovation and technological development including:
    a. Advanced Survey Technology in acoustics and optics for fisheries, protected species and habitat studies
    b. Operation of NOAA's only instrumented autonomous underwater vessel (AUV).
    c. Research and development of passive acoustics methods for the detection of marine mammals during line transect surveys and analytical methods to identify species of marine mammals from their sounds.
    d. Advancement of molecular ecology studies.
    e. Collection of marine mammal, marine turtle and California Current fish tissue used to determine stock origin in near real-time, population structure and the "units to conserve" using state-of-the-art genetic methods as well as the development of new techniques for determining life history parameters such as pregnancy.
11. Socio-economic studies on trans-boundary and trans-national ecosystem-based fisheries management issues.
12. Designing and implementing new quantitative strategies for the management of marine mammals and marine turtles and all ESA-listed species.
13. Development and scientific support for implementation of ecosystem-based management in Antarctica for the conservation objectives of the Antarctic Treaty system including:
    a. conduct annual field investigations of prey, predators and their environment in the South Shetland Islands Region using ship-based and land-based surveys, process specimens and produce annual report.
    b. provide annual assessments for CCAMLR.
    c. synthesize data from several surveys of benthic fishes and invertebrates as the framework to outline approaches for quantitatively describing Vulnerable Marine Ecosystems in Antarctica.
14. Abalone research through in-situ observations (using remotely operated vehicle and multi-beam mapping) to monitor abundance and describe the status of populations of endangered white abalone and other abalone species of concern.

Quality assurance

The Southwest Fisheries Science Center has a long history of regular internal program reviews and a recent history of several external program reviews. Historically, the SWFSC conducted annual program reviews as part of its program planning and budget allocation process. All scientific activities were reviewed on a Division by Division basis. In 2006, the reviews were conducted on a program basis with programs defined according to the

matrix above. These reviews were mostly internal reviews, although some Headquarters staff observed, and in some cases, there was limited participation of external scientists and/or stakeholders. This annual reviews of the entire Center have not been conducted since 2006.

In addition to internal reviews, the SWFSC has also conducted several external (typically about five non-SWFSC scientists) as follows:

- Salmon Research Program, Fisheries Ecology Division (Santa Cruz Laboratory)- 2003
- Population Assessment Program (corresponding to the matrix above)- 2008. Two of the reviewers were from the Center for Independent Experts (CIE). The intent was to have a five year cycle for conducting reviews of the programs in the matrix.
- Antarctic Ecosystems Research Division- 2009
- Marine Mammal and Turtle Research Programs- 2009
- CalCOFI (California Cooperative Fisheries Investigation)- 2010. CalCOFI is a cooperative program of the SWFSC, Scripps Institution of Oceanography (SIO), and California Department of Fish and Game (CDF&G).
- Acoustics Program- planned for 2011. The review is to be a PFMC STAR panel format convened to review the acoustics method. The panel will include members of the Center for Independent Experts (CIE).

Following external reviews, the SWFSC prepares a response to review recommendations.

In addition to reviews of programs and research divisions, the SWFSC participates in stock assessment reviews conducted by STAR panels (which are described in the section of this report on the NWFSC). SWFSC scientific input to salmon ESA listing decisions use Technical Recovery Teams, comprised of NOAA, academic, state, tribal, federal and other scientists, similar to the TRTs described for the NWFSC. The Marine Mammal Protection Act Pacific Scientific Review Group (SRG) conducts an annual review of marine mammal assessments and other scientific products. Scientific products of the SWFSC are also reviewed and/or commented on and/or produced in collaboration with international organizations including the Commission for Conservation of Antarctic Living Marine Resources (CCAMLR), International Whaling Commission (IWC), International Scientific Committee for Tuna and Tuna-like Species (ISC), Inter-American Tropical Tuna Commission and the Western Central Pacific Fisheries Commission (WCPFC).

The Southwest Fisheries Science Center document review policy requires an internal peer review and Division and Center Directorate approval of documents submitted for publication. There were 425 external peer reviewed publications in the 4 year period 2007-2010.

Program management

Until recently, the annual review of divisions and programs of the SWFSC as described above was one of the Center's primary program management processes. However, absent a permanent Director for the last three years, it is our assessment that program management has deteriorated. The Director of the NWFSC has served as Acting Director of the SWFSC during the last year, which has help to restore some senior level scientific direction and leadership. However, responsibility for program management has largely fallen on the Division Chiefs in the absences of a permanent Science Center Director.

The SWFSC does not have a Strategic Plan.

Other observations

1. It was noted that the report of the 2008 Population Assessment Program has yet to be finalized. The Chair of the review was from the Office of Science and Technology.
2. The SWFSC historically required a large amount of ship support to conduct Congressionally-mandated cruises in the eastern tropical Pacific (240 DAS for this cruise alone in each of 1986-1990 and 1999-2000; 360 DAS in 1998). More recent allocations have dropped substantially (e.g., average of 550 DAS in the mid-2000s to ~280 in 2010). The SWFSC used 270 hours of aircraft time in 2010. Is this mission forever, or have scientific aspects of the tuna-dolphin problem been solved after 40 years of research and countless millions of dollars?
3. The impact of temporary funds from NOAA and reimbursables on overall program strategies and priorities needs to be evaluated, but it has important positive and negative effects.
4. The nature of reviews needs to take account of the reason for reviews are conducted. Some reviews are conducted to advertise a program and garner support. Other reviews are aimed at critically determining performance. The later need to be more intense than the former, and stakeholders typically play a lesser role. This is a general consideration for all of NMFS and NOAA. The two purposes should not be confused.
5. The SWFSC has generally made less use of the CIE than other Centers. However, CIE members are part of STAR panels used by the SWFSC for scientific input to fisheries management.
6. The SWFSC conducted a series of internal briefings/reviews covering the entire Center in 2010. These were aimed at orienting the Acting Science Director.
7. Recent reviews were directed by Headquarters. The general view of the Center Division Directors and staff feel this was a response to perception that without permanent leadership, the Center was adrift.
8. SWFSC scientists chair the key Committees of CCMALR (on fish stock assessments and on ecosystems).
9. The SWFSC will be involved in the scientific work South Pacific Tuna Treaty.
10. As a result of FACA concerns, SWFSC program reviews have sometimes called for separate reports from individual reviews. In general, this is an inefficient way of conducting reviews.

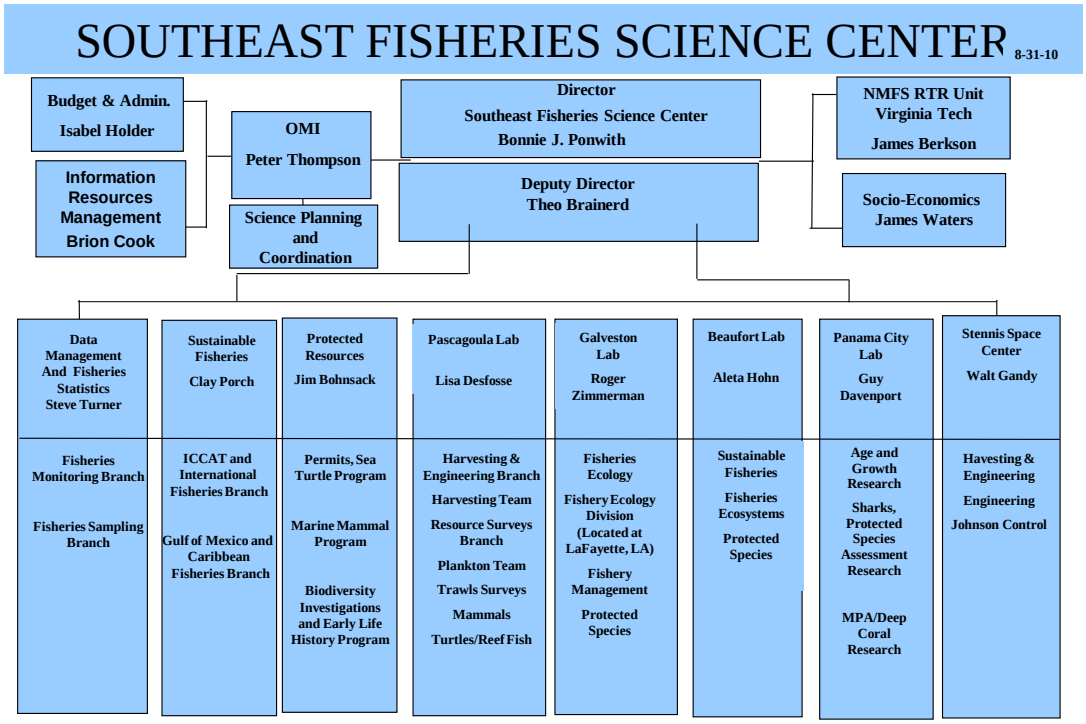
11. The SWFSC expressed frustration by the lack of feedback from HQ on reviews that were directed by HQs. This is a re-occurring theme with respect to HQ (lack of feedback).
12. How can the NMFS Science Board be more effective providing strategic leadership?

SOUTHEAST FISHERIES SCIENCE CENTER

Organization and programs

The Southeast Fisheries Science Center (SEFSC) is headquartered at the Miami (Florida) Laboratory. It has laboratories at Beaufort, North Carolina, Panama City, Florida, Pascagoula, Mississippi, Galveston, Texas, and at the Stennis Space Center, Mississippi. It also has staff at a laboratory in Lafayette, Louisiana. The SEFSC provides scientific support for three Fisheries Management Councils (South Atlantic, Gulf of Mexico, and Caribbean), Atlantic States Marine Fisheries Commission, Gulf States Marine Fisheries Commission, and the International Commission for Conservation of Atlantic Tunas (ICCAT). Arguably, ICCAT is the most demanding of the international commissions served by a NMFS Science Center, and arguably the number, diversity and political demands of customers of the SEFSC is greater than for other Centers.

The SEFSC organization is a combination of Laboratories and Divisions within the Miami Laboratory, as indicated in the organization chart:



The organization appears to be a "legacy" organization without apparent logical architecture (e.g., by discipline, ecosystem, mission area, or scientific question). Major activities (stock assessments, protected species science, habitat research, etc) occur in multiple Divisions and Laboratories.

The 2010 budget of the SEFSC is $67.9 million. Approximately 79% of the budget is "permanent" (anticipated year after year). Most of the remainder of the budget is temporary transfers from NMFS Headquarters or NOAA. Reimbursable funds from outside of NOAA are minor. There are 277 federal employees, 156 contact staff and 1 post doctoral fellow.

The scientific activities of the SEFSC are summarized as follows:

1. For the South Atlantic Bight, conducts field sampling, stock assessments and simulation modeling to improve tracking and prediction of fish population abundance and understand causes of population fluctuations.
    a. menhaden studies including monitoring and sampling the commercial fisheries for Atlantic and Gulf of Mexico menhaden. Data collection includes captain's daily fishing reports and biological samples from purse seine catches of menhaden. The biological samples are collected for information on fish length, age, and weight.
    b. Stock assessments for other South Atlantic Bight stocks.
2. Conducts Southeast Region Headboat Survey monitoring and sampling the recreational headboat fisheries in the Atlantic and Gulf of Mexico. Data collection includes catch records from every trip and biological samples from dockside intercepts by port samplers. The biological samples are collected for information on fish length, age, weight, and sex.
3. In the South Atlantic Bight, conducts research on reef fish early life-history patterns, habitat restoration ecology, the use of otolith microchemistry to assess spatiotemporal distribution patterns, otolith-derived age validation studies, genetic connectivity of reef fish populations, reef fish spawning aggregations, reef fish reproductive ecology, temperate hardbottom community ecology, predator-prey relationships, invasive species impacts, and spatiotemporal trends in age and growth patterns.
4. The Southeast Fishery-Independent Survey (SEFIS) monitoring reef fish in southeast US continental shelf waters. Initiated in 2010, SEFIS works cooperatively with the long-term and ongoing MARMAP sampling program to (1) provide fishery-independent data to support reef fish stock assessments and (2) perform reef fish ecology research.
5. Stock structure of bottlenose dolphins from New Jersey to Florida. The program collaborates with many partners to integrate several approaches to delineate stocks, including photo-identification, telemetry studies, stable isotope ratios, and genetic analyses taken from skin samples.
6. Studies of marine mammal strandings and fishery interactions from New River, NC, north to the VA/NC border from 1997 to 2009. Collects samples and data for over 30 species. Determines whether a stranded animal were or had been entangled in fishing gear.
7. Conducts and participate in research on bottlenose dolphins including:

a. Comparing the health of dolphins from different stocks exposed to different stressors or situations (e.g., diseases, chronic exposure to contaminants, and harmful algal blooms.
b. Identifying prey species and estimates the biomass consumed and creating digital ontogenetic otolith catalogue for fish species in North Carolina waters.
c. Studies of age and reproductive parameters, primarily of bottlenose dolphins, but also of other species, including from South America and the beluga whale and narwhal from the Arctic.
d. Studies of environmental drivers of the distribution of bottlenose dolphins using satellite-derived location data (from satellites) linked to evaluate the functional mechanisms underlying the distribution pattern of bottlenose dolphins from New Jersey to northern Florida.

8. In water sea turtle population studies on demographic parameters, such as survival, emigration, and immigration, along with abundance, stock structure, and sex ratio data, are integral into population assessments. Mark-recapture studies are conducted using turtles caught either incidentally in pound nets or through directed capture using large mesh gillnets. Satellite tags are also applied. Surfacing intervals information collected through satellite telemetry are also being used to produce correction factors for calibrating abundance estimates obtained from aerial survey data.
9. Operates the National Sea Turtle Aging Laboratory developing and refining methods to obtain information about sea turtle ages, stage durations, and growth rates, which can then be incorporated into population models. Bones are histologically processed to highlight skeletal growth marks, which are analyzed to obtain age and growth data. Applies stable isotope analysis to investigate the timing of ontogenetic habitat shifts. Estimates age at maturation. Will evaluate the effects of the Gulf oil spill on growth and life-history of sea turtles.
10. Monitors pink and brown shrimp fisheries of the Gulf of Mexico. Evaluates catch statistics, trends, present versus historical conditions and changes in regulations and economic conditions. Alternate Gulf of Mexico management options are currently being evaluated including limited entry, catch quotas, vessel/gear/effort limitations, and other time/area closures.
11. Annual shrimp stock assessments for brown, white and pink shrimp to monitor trends in the shrimp fishery. Conducts stock assessments by species, determining if stocks are in a state of recruitment overfishing.
12. Annual forecast for Gulf of Mexico brown shrimp on the harvest off Texas and Louisiana.
13. On board observers for the Southeast shrimp fishery to monitor and evaluates the performance of bycatch reduction devices (BRDs) and turtle excluder devices (TEDs. Observers collect data includes information on overfished species such as red snapper, king and Spanish mackerel, and provides information to state and

federal bycatch reduction programs, and evaluates area-wide potential losses of overfished species.

14. Runs observer program associated with petroleum platform removals to reduce interactions with endangered sea turtles and marine mammals.
15. Deploys At Sea Observers on reef fish fishing trips in the Gulf of Mexico.
16. Runs electronic logbook program for the offshore shrimp fishing fleet of the Gulf of Mexico for over 500 vessels.
17. Research on coastal marshes, submerged aquatic vegetation, bay bottoms, oyster reefs, mangroves, and coral reefs including:
    a. Examination of the relative importance of different habitats in support of fishery production. Measures density patterns and conducts field and laboratory experiments to understand the role of habitats and ecological factors in the distribution of fishery species.
    b. Developing ecological models that link habitats and fishery production, describing how ecological interactions affect fishery species, and allowing the use habitat science and ecology in stock assessments.
    c. Studies of habitat restoration techniques and their effectiveness.
    d. Assessment of environmental impacts of human activities (e.g., liquefied natural gas processing, Deepwater Horizon oil spill) on fisheries and ecosystems.
18. Trophic modeling (Ecopath/Ecosym) of the Gulf of Mexico and Caribbean Sea to examine the effects of MPAs. Also developing a watershed model of Galveston Bay
19. Conducts captive rearing program for loggerhead turtles. Turtles are used to test Turtle Excluder Devices and for other bycatch reduction studies.
20. Studies of molecular, cellular, immunological and biological effects of environmental pollutants on sea turtles.
21. Studies of pharmacokinetic antibiotics to improve care of sick or injured sea turtles.
22. Studies of the potential impacts of anthropogenic noise on sea turtles.
23. Research on tag attachment methodology for loggerhead sea turtles.
24. Application of passive Integrated transponder (PIT) and coded wire tags (CWT) to sea turtles.
25. Gear research including:
    a. Turtle excluder device certification. Satellite tags are used to monitor survival of turtles used in testing.
    b. Studies of longline bait to reduce turtle hooking.
    c. Testing of fiberglass model sharks as turtle deterrents.
    d. Hook modifications to reduce bycatch of turtles.
26. Protected species standings program including:
    a. Salvage, rescue and rehabilitation of stranded sea turtles.
    b. Beach surveys for stranded sea turtles and marine mammals.
    c. Satellite telemetry of wild sea turtles.

27. Performing stock assessments for highly migratory species including bluefin, yellowfin, bigeye, skipjack and albacore, as well as swordfish, blue marlin, white marlin, and sailfish.
28. Research on incorporation of environmental factors into Catch Per Unit Effort standardization.
29. Integrated ecological assessment of the Gulf of Mexico.
30. Research on the biology of highly migratory species including operation of a long term cooperative tagging program.
31. Monitoring of billfish tournaments.
32. Perform assessments on stocks of the Gulf of Mexico and Caribbean Sea including groupers, snappers, coastal pelagic, spiny lobster, conch, and other reef fish. Many assessments require development and applications of methods for data poor situations.
33. Design and implementation of a pilot cooperative fishery-independent survey project for St. Croix.
34. Conduct fishery-independent resource surveys for the Southeast Region, including spring, fall, winter and piggybacked plankton surveys, fall and summer bottom trawl surveys, small pelagic high opening bottom trawl survey, reef fish surveys, oil rig monitoring, vertical longline survey, bottom and pelagic longline surveys, coastal long line survey, shipboard and aerial marine mammal surveys.
35. Research on harvest technology for sea turtle and finfish bycatch reduction.
36. Engineering of digital video camera array for the reef fish surveys, evaluation of technologies for automated image processing for reef fish video, and plankton surveys, evaluation of advanced technologies for data collection such as gliders and AUVs, development of an acoustics program for the new NOAA ship multibeam capabilities, and engineering and communications support for the NOAA small vessels.
37. Studies of the biology (age and growth, maturity, stock structure) of mackerel and reef fish.
38. West Florida Shelf trap/video surveys establishing long term data base utilized for evaluating reef fish.
39. Multibeam portable side scan sonar detailed mapping of the West Florida Big Bend area.
40. Conducts fishery and habitat research on designated and proposed MPAs in the southeastern United States.
41. Conducts surveys for deepwater corals and sponges.
42. Biological research and assessments of sharks.
43. Observers on drift net and bottom longline fishing trips for sharks.
44. Studies of movements and abundance protected species including sawfish, Gulf sturgeon movements and habitats, Alabama Shad, marine mammals and sea turtles, and Johnson's seagrass.
45. Conducts biodiversity and protected species research including:

a. Studies of ecology and restoration of hard bottom benthic communities,
b. Icthyoplankton studies,
c. Research to develop and employ innovative visual, optical, and acoustic methods and technology to collect fishery-independent data on the status of exploited and non-exploited coral reef species with emphasis on non-destructive technology to support ecosystem based assessments,
d. Participation in the Comprehensive Everglades Restoration Project (CERP) for South Florida.

46. Trains future NMFS fishery scientists at the Recruiting, Training and Research (RTR) Unit at Virginia Technical University.
47. Social science research including:
    a. Data collection on the financial and economic performance of the fishing industries.
    b. Development of economic models to evaluate management proposals.
    c. Socio-cultural research to develop baseline data about the lifestyles, social networks and communities of commercial and recreational fishermen in the southeast.
48. Collection of fisheries statistic including:
    a. Dealer reports from Texas to North Carolina including trip level data beginning in 2011
    b. Quality assurance support for trip data collected by Florida, Alabama and Louisiana.
    c. Quota monitoring in support fishery management.
    d. Monitoring landings of swordfish and sharks by highly migratory species fishing trips by US vessels throughout the Atlantic Ocean.
    e. Catch monitoring for the Wreckfish ITQ fishery.
    f. Designing a cooperative fisheries statistics monitoring program for the US Caribbean.
    g. Commercial fishery logbook program for the Southeast region.
    h. Dockside biological sampling.
    i. At sea observer programs (sea sampling).
    j. Support for marine recreational fishing data collection in the Southeast Region.

Quality assurance

The SEFSC does not have program review policy, but it seems to be aiming at one program review per year across broad areas of Center activity, not necessarily a Division or Laboratory. There seems to be a developing plan for a program review of fishery independent data collection and data management (no documentation was provided). When asked for the criteria for prioritizing program reviews. None were given, but "stock assessments", and "fishery independent data" (surveys) were identified as the next priorities.

The most recent external program review organized by the SEFSC was the coral reef research program review conducted in 2004. The Center conducted an internal review of the Pascagoula Lab's fishery independent survey program in 2008, but there does not appear to have been any follow-up. SEFSC programmatic activities have been covered by some National Research Council reviews in the last decade including reviews of sea turtles and recreational statistics. They were also included in a National review of the NOAA Coral Reef Program in 2006 and a review of headboat recreational fisheries statistics collection in 2006-2007. Only reports from the 2004 coral reef review and the internal Pascagoula Lab review were provided.

SEFSC stock assessments are reviewed by the Southeast Data, Assessment and Review (SEDAR) process. The process generates benchmark assessments through series of 3 workshops to review available data, assessment methods and results. It is an intense process with independent scientists participating in each of the workshops. Priorities are set by a steering committee made up of leaders from the SEFSC, Southeast Regional Office, the three Regional Fishery Management Councils served by the process, and the two Interstate Commissions.

The SEDAR process has been operating for about a decade or longer, and while it has some important strengths (independent review, stakeholder participation in priority setting, transparency), there seems to be a general recognition it is not working well enough. The fundamental problem is that the production rate (number of new assessments per year) of SEDAR is too low to satisfy user needs. Also, SEDAR is intended to produce benchmarks assessments that can be updated for several years between SEDAR assessments, but this has not generally been the situation. There seems to be enough changes in data, assessment methods or the fishery situation, or so much controversy, that simple updates (so called turn the crank using data and methods agreed by a benchmark) are deemed inadequate.

The Center recognizes the limitations of the SEDAR process, and we were told that changes were being made so that it would produce enough assessments to satisfy user needs. However, we were not given any information about how this objective will be achieved.

The SEFSC uses the Center for Independent Experts (CIE) primarily for external/independent panel members during SEDAR review workshops. The Center seems generally positive about the use of CIE. While the Center felt that the reports of individual CIE members were useful for future scientific planning (correcting problems, pursuing new ideas), they are not helpful in communicating and defending consensus conclusions from the SEDAR process.

Not all SEFSC stock assessments are subject to the SEDAR process. SEFSC stock assessments for highly migratory species (HMS) are reviewed by the Scientific and Statistical Committee of the International Commission for Conservation of Atlantic Tunas (ICCAT). Major assessments for bluefin tuna and swordfish are conducted every few years. The SEFSC conducts assessments of other HMS stocks (e.g., marlins) and it plays an important role in most of the ICCAT assessments. Two out of the last three chairs of SCRS have been SEFSC scientists. In general, the quality assurance of stock assessments provided by SCRS seems to be satisfactory, and the SEFSC seems to be able to conduct the assessments required by users (i.e., ICCAT).

Sea Turtle research products of the SEFSC are reviewed by the Sea Turtle Expert Working Group set up by NMFS Headquarters, although it has not been active in recent years. Both the SEFSC and the Northeast Fisheries Science Center (NEFSC) participate. There are also external (non-Agency scientists) that are members of the Working Group (apparently allowed as a result of a FACA exemption).

Scientific support for Endangered Species Act listing decisions is provided by Biological Review Teams (BRTs) made up of federal scientists only (presumable because FACA prohibits non-Federal scientists). BRTs are a useful way of creating a scientific basis of decisions separate from management determinations, but it is unclear how the work of BRTs is quality assured (e.g., subjected to independent peer review). One option is to use reviewers from the CIE Also, the acceptance of biological review teams as a normal way of obtain scientific input into listing decisions does not seem to have been universally agreed by Regional Offices and Headquarters, although they are favored by all of the Centers. .

Biological options on the impacts of actions (e.g., permitting a fishery) on listed species also requires scientific information. Most Biops (as they are known) are produced by the SERO without Science Center input or review. This is generally the case throughout the country. Since there are potentially a large number of Biops for many relatively minor actions, it would be an unwelcome workload for Science Center scientists to be involved in very many, but some Biops are important enough to merit a scientific support from the Centers, with some level of quality assurance.

Marine mammal assessments are submitted to the Atlantic Scientific Review Group (SRGs) established under the auspices of the Marine Mammal Protection Act. SRGs are made up of non-federal scientists.

Scientific products on essential fish habitat are subject to review by the Scientific and Statistical Committees of the Fishery Management Councils that use the information.

Scientific documents of the SEFSC are subject to a Publication Review Policy that requires papers to be reviewed internally and approved by a Division or Laboratory Director, and the Science Center Director. SEFSC scientists published 783 journal articles in the period 2000-2009. There were also 62 books and 92 book chapters although there is some double counting (e.g., 35 book chapters appeared in one of the books).

Program management

The SEFSC did not indicate it has a strategic plan, although some of the laboratories or divisions have plans. There are also some program plans that cut across laboratories and divisions. The SEFSC contributes to national strategies (e.g., stock assessment improvement plan, habitat improvement plan, social sciences improvement plan, data acquition plan, etc.). Documentation of these plans and strategies were not provided. A concern is that many of these National plans are primarily aimed at the out year budget formulation processes. Such plans are not necessarily scientifically rigorous enough to guide implementation of a scientific programs.

When asked about the management structures or processes used by the SEFSC, the response was there is an annual retreat and weekly phone or video conferences with the management team. When asked how budget allocation decisions are made, the response was that they depend on getting new funds from Headquarters or the Regional Office. Management structures and processes at the Center level are unclear, and it seems that most management responsibility is left to the Divisions and Laboratories. We were also told that Electronic Annual Operating Plan (eAOP) milestones are used to manage the Center, although no reference to eAOPs was made during the presentations of Laboratory or Division programmatic activities.

Other observations

1. It was noted that the Panama City facility is not a laboratory in an organizational sense. It is a Division of the Miami Laboratory, which is a concern for the Science Center Director as it limits the grade structure within the facility.
2. Our general sense is there is too little differentiation made between the plans used to compete in the out year Presidential budget formulation processes (aimed at budget analysts), and scientific planning which needs to be credible with scientists.
3. Experience scientific leadership in the SEFSC seems to have diminished with the loss of several key scientists over the last decade.
4. The SEFSC seems like a legacy organization with a lot of similar activities occurring in each Division and Laboratory. The degree of coordination or overlap in these activities is unclear. The response we got when we asked about changing the organization is that organizational changes in NOAA requires approximately 18 months and tends to

be disruptive. Therefore, there was no indication that changes were being considered, or have been initiated or denied, except for a recent change setting up a Data Management Division.

5. Habitat research occurs in all of the laboratories of the SEFSC, but there does not seem to be an overall strategy, basis for priority setting, or framework for comparison of results. The Center explained that priorities are based on the requirements of the broad array of sources that are used to fund habitat science. When we asked about a strategy, the response was that a strategy cannot be implemented without more money unless something that's being done now is dropped. Dropping something did not seem like a consideration.
6. When we asked questions that suggested something might be changed (like coordinating habitat research among the laboratories), we were told several times the Center was thinking about it. There is a Science Center lead for habitat issues who represents us on national- and regional-scale planning efforts. Coordination among the labs is done for work in similar systems. Release of the Habitat Assessment Improvement Plan serves as a good backdrop for stronger coordination of our strategic planning efforts. Coordination among laboratories to take on larger (geographically and temporally) would be beneficial.
7. The tension between the SEFSC and SERO is obvious. SERO relies on the Science Center for scientific advice. As a policy, the agency has partitioned the division of labor to place science in the hands of the Science Centers. According to the Center, growth in the demands for science advice puts pressure on the Science Center for increased productivity and creates the temptation in the Regions to satisfy science requirements internally. Much of the tension revolves around managing these pressures. This tension is in contrast to generally complementary comments the western Centers made about their ROs, and positive comments about the Centers we heard from the two western Regional Administrators (PIRO, NWRO) that were interviewed.
8. The SEFSC uses a large number of sea days with two NOAA vessels dedicated to its mission, and use of the RV Nancy Foster, RV Savannah, and other vessels. It has a lot of survey time series, but we often heard that it lacked fishery independent abundance indices needed for fish stock assessments (for example compared to the NE or Alaska regions). The explanation was that the area is large (it is compared to the Northeast, but not Alaska) and variances were higher presumably because of habitat and species diversity. However, we think this issue merits a more rigorous evaluation. In this regard, follow-up on the internal review of fishery independent data conducted by the SEFSC in 2008 is needed.
9. Center scientists expressed concern about the HQ Protected Species Office in terms of the impediment of the research permit process and budget allocation decisions. It was noted that the HQ Office was not supportive of at sea research on turtles advocated by the SEFSC to estimate abundance and vital rates. A recent NRC report confirmed the priority for at sea abundance estimation.

10. We were not provided any information on the Center's response to the program reviews that had been conducted. We did not ask for a description of responses to reviews, so they may exist. However, it was acknowledged that there had been much follow-up to the internal review of the Pascagoula Laboratory a few years ago (see number 8 above). Some Centered volunteered documents describing their responses.
11. The Center seems to be giving a priority to quality assuring and modernizing fishery dependent data collection and management. It has formed a new Miami Division with this responsibility. However, the Division does not have authority over all of the important fishery data collection programs.
12. IT expert of the SEFSC is distributed throughout the SEFSC (a few people here, there and everywhere). There does not seem to be overall leadership for information technology and data management.
13. The SEFSC cooperative research program is run out the SERO in contrast to other regions where it is a Center responsibility. One of us recalls an Agency decision to run cooperative research out of Science Centers. At that time, cooperative research was transferred from the NERO to the NEFSC, but apparently, the decision was not followed in the Southeast.

    It is interesting that the SEFSC has so much difficulty producing assessments frequently enough to satisfy user needs (except for ICCAT). Assessments are needed for about 30 stocks in the Gulf of Mexico (of which 5 or 6 are high profile), less than 5 major ICCAT stocks and about 5 South Atlantic stocks. There are currently 14 stock assessment scientists in the Miami laboratory with 6 more positions being filled. There are stock assessment scientists in other laboratories. Is about 20-25 scientists enough for 40 stock assessments or less, with a frequency of once every two to five years (maybe 15 per year on average)? This workload seems to be comparable to other regions. SEFSC are as skilled and hard working as other stock assessment scientists in the agency. Is the problem that the assessments are harder, data is poorer, processes are less efficient, or users are more critical and demanding? Hopefully, the plan for six more stock assessment scientists will solve the problem?
14. The head of the SEFSC social sciences program was positive about the leadership and support received from Headquarters. It was noted that the social sciences program has benefited from social scientists in HQ that are respected (based on their economics and social sciences experience and credentials) by colleagues in the field. This is in contrast to several other important disciplines.

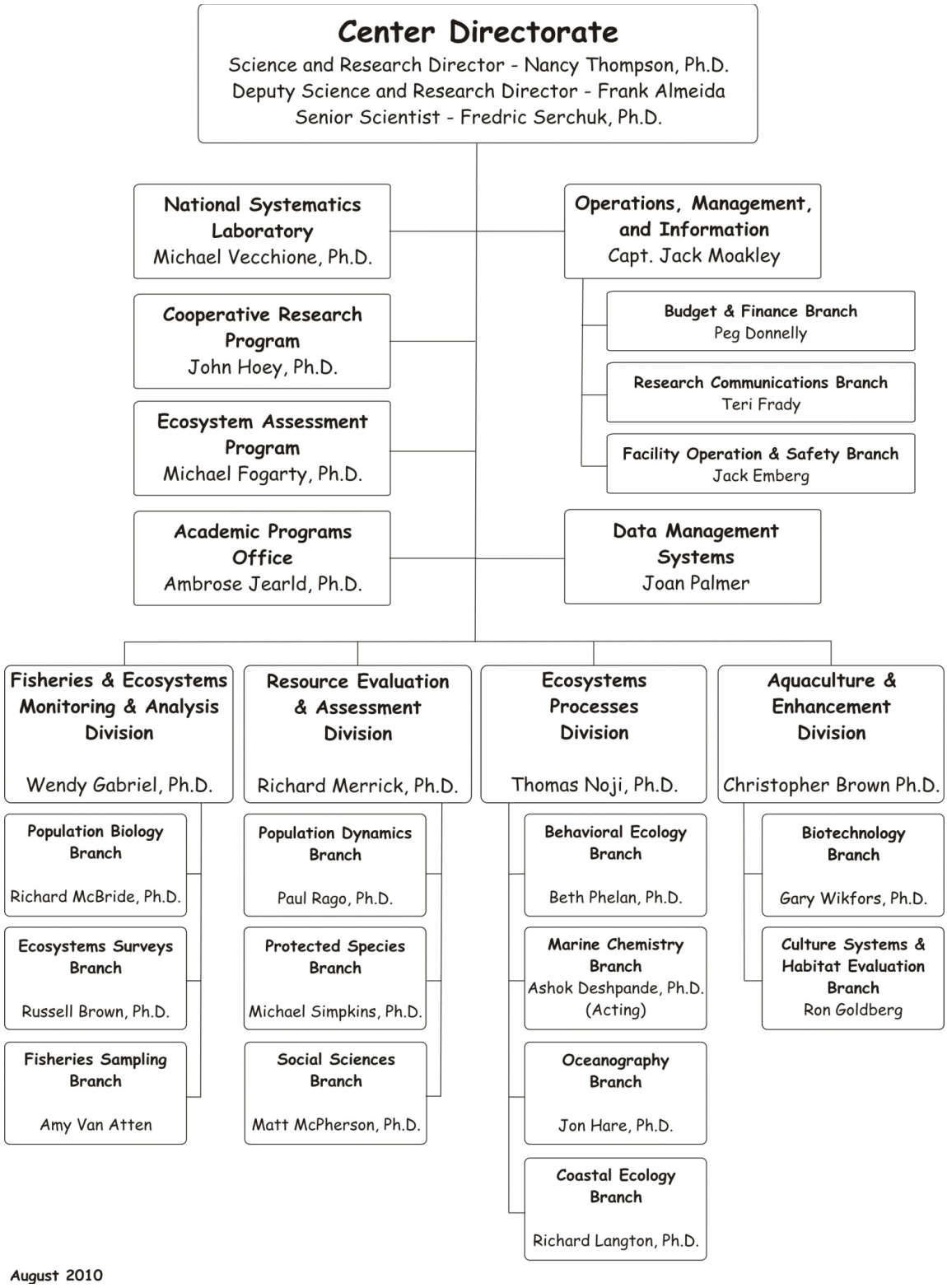
NORTHEAST FISHERIES SCIENCE CENTER

Organization and programs

The Northeast Fisheries Science Center is headquartered in Woods Hole, Massachusetts. It has laboratory facilities in Narragansett, Rhode Island, Milford Connecticut, and Sandy Hook, New Jersey. It also has staff collocated with the Smithsonian Institution in Washington, DC., and it has a field station in Orono, Maine. Historically (in the last 40 years), there were laboratories in Boothbay Harbor, Maine, Gloucester, Massachusetts, and Oxford, Maryland. These laboratories were transferred to other Agencies to improve integration of NEFSC programs, eliminate low priority programs and to reduce the overhead cost on programmatic activity.[4]

The NEFSC is organized into Divisions. Laboratories are physical facilities that house staff, but they do not have organizational status. The organization is given in the figure below. It evolved from a major reorganization in the mid 1980s (when the previous organization was entirely abolished and replaced). The organization consolidates major activities into divisions as follows: (a) fishery dependent and fishery independent data collection- Fisheries and Ecosystem Monitoring and Analysis Division, (b) research on oceanographic and ecological processes- Ecosystem Processes Division, (c) analyses in support of policy and management- Resources Evaluation and Assessment Division, (d) information technology and data management- Data Management Systems, and (e) program support- Operations, Management and Information, into large organizational units. The National Systematic Laboratory at the Smithsonian Institute is a center of excellence for the entire Agency managed by the NEFSC, and the Aquaculture and Enhancement Division conducts research that supports an agency mission area that waxes and wanes in the priority it is given by the Agency. The Ecosystem Assessment Program was recently created. Our impression is that it is primarily a mathematical and statistical modeling group.

[4] The only other significant laboratory NMFS has closed since NOAA was form was in Port Aransas, TX (sometime around 1970).



The 2010 budget of the NEFSC is $88.1 million. Approximately 86% of the budget is permanent. Most of the remainder of the budget is temporary transfers from NMFS

Headquarters or NOAA (11%). Reimbursable funds from outside of NOAA are minor (3%). There are 285 federal employees, 299 contact staff (200 in the observer program) and 10 post doctoral fellows.

The scientific activities of the NEFSC are summarized as follows:

1. Research in aging and growth, reproductive biology, predator-prey interactions, and distribution and migration patterns of groundfishes (cods, hakes, and flounders), pelagic fishes (mackerel, herring), elasmobranchs (sharks, skates, and rays), and select invertebrates (surfclam, squid, and northern shrimp).
2. Collection of fishery independent data during standardized research vessel surveys from Cape Hatteras to the Scotian Shelf. Surveys also provide oceanographic and plankton data for monitoring the health and status of marine resources and their habitat. Survey gathers data on distribution, abundance, feeding ecology, size and age composition of specimens collected.
3. Design and testing of sampling gear and evaluation of hydroacoustic systems for pelagic species and squid.
4. “Data rescue" to preserve the NEFSC historical data archives in digital format and to make the information available to users in the scientific community. Includes scanned images of biological and oceanographic data sheets from cruises conducted during 1948-1975, and a description of the data from selected bottom trawl surveys conducted during 1948-196
5. Collects, processes, manages, and provides fishery dependent data and biological samples obtained from observers on fishing vessels. Collects information on fishing operations, fishing effort, and catch, including bycatch and discard information, economic data and vessel efficiency, biological samples of landed catch and discards, and interactions with protected species. The data are processed and maintained in a central database for access by users or provided directly to the user. Biological specimens and samples (e.g., scales and otoliths) are collected and distributed.
6. Conducts applied economic and socio-cultural research on the use and management of commercial and recreational fisheries, protected species resources, and marine ecosystems. Evaluates economic and socio-cultural effects of existing and proposed management programs. Conducts reviews of the benefits, costs, and social impacts of regulatory interventions.

7. Maintains market news offices in Boston and New York to collect and broadcast local and national product price and inventory information in support of the development of efficient, reliable markets.
8. Provides advice to resource managers on the status and trends of abundance and productivity of marine fishery resources off the Northeast coast of the US. Evaluates the effects of management on populations and fisheries.
9. Develops improved quantitative methods for stock assessments and forecasting trends and ecosystem modeling. Research deals with mixed fishery and multispecies effects on fisheries and ecosystems.
10. Other population dynamics studies including:
    a. Monkfish Egg Veil Sighting Network
    b. Online Fish Tag Reporting
    c. Collaborative research between the NEFSC and the Illex squid industry
    d. Monkfish Research Survey
    e. Cooperative Black Sea Bass Tagging Project
    f. Cooperative Scup Tagging Project
    g. Cooperative Yellowtail Flounder Tagging Project
    h. Research on endangered Atlantic Salmon including scientific input to the North Atlantic Salmon Commission.

11. Conducts research on protected species (under the Endangered Species Act and Marine Mammal Protection Act) concerning:
    a. ecological rules and habitat,
    b. human interactions including bycatch mitigation,
    c. population assessments, including the determination of Potential Biological Removals (PBR) of marine mammals.

    Research primarily concerns Northern right whales, humpback whales, harbor porpoise, harbor seals, and sea turtles. Conducts aerial surveys and shipboard surveys. Gear research to reduce interactions with fisheries is conducted.

12. Scientific support for the US delegation to the International Whaling Commission.
13. Conducts multidisciplinary, experimental, and community based approaches to investigate mechanisms that affect recruitment, distribution, and abundance of marine fishes and invertebrates. Field and laboratory studies of habitat requirements and preference, predator-prey relationships, movement and migration patterns, reproductive behavior, and other behavioral responses are studied. Emphasis is placed on species interactions, environmental parameters, such as sediments, macrophytes, water column characteristics, and hydrography.
14. Process oriented research on the influence of the environment and lower trophic levels on living marine resources. Research includes collection of temperature and salinity data on

almost all Center cruises to monitor the seasonal and inter-annual variability in the water properties on the northeast continental shelf. Specific focus is given to studying the physical and biological processes which control the growth and survival of the early life stages of fish populations and of their zooplankton prey organisms.

15. Conducts field and laboratory studies on habitat and ecological requirements of fishes and invertebrates and how they are affected by natural processes and anthropogenic activities. Research addresses the functional value of habitat and how habitat loss and degradation, as well as mitigation or restoration efforts, affect productivity and diversity.

16. Research on the effects of mobile fishing gear (bottom trawls) on habitat and methods for refining the designation of essential fish habitat.

17. Studies of marine chemistry related to the health and well-being of marine resource species, and the extent to which environmental contamination affects sustainability and utilization. Studies include contaminants in water, sediment, and tissues of fishes and invertebrates to address accumulation and food web transfers. Measurements are made of nutrients, trace metals and organic contaminants. Emphasis is placed on developing new more rapid and cost effective detection techniques. Projects include:
    a. Importance of the chemistry of marine habitat on functional value,
    b. Studies of the transport of terrestrially derived organic matter and nutrients along the middle Atlantic coast,
    c. Studies of the first year survival of juvenile bluefish using chemical analysis of otoliths,
    d. Microchemistry of otoliths for stock identification including studies of bluefin tuna,
    e. Analysis of PCBs in humback whale lipids to study energy transfer.
18. Aquaculture research to develop better broodstock, improved disease resistance and disease treatment and nutritional requirements of shellfish and coastal finfish, including:
    a. Microbiology, immunology, genetics, pathology, and algal nutrition studies to define health, survival, and growth in both an aquaculture setting and in nature.
    b. Development of culture systems.
19. Taxonomic research to describes and names new species, and revises existing descriptions and names based on new information, of fishes, squids, crustaceans, and corals of economic or ecological importance to the United States.
20. Application of ecosystem and statistical models to synthesize information on climate, oceanographic, and human-related pressures to evaluate their impacts on ecosystem structure and function. Primary products include Ecosystem Advisory Reports, Integrated Ecosystem Assessments, and Fishery Ecosystem Overview reports. Conducts evaluations of fishery management strategies in the context of ecosystem processes and dynamics.
21. Research on the ecological affects of ocean acidification including:
    a. Multi-year ship board field study collecting water samples from the surface to the ocean floor for a variety of chemical and biological measures to better understand

the affects of ocean carbon concentrations on productivity,

b. Laboratory studies of phytoplankton cultures on the effects of pH (acidity).

22. Cooperative research with fishing industry interests to improve the data upon which fishery management decisions are made, and to improve coordination, cooperation, communication, and mutual respect among scientists, managers, and members of the industry. An emphasis is placed on providing high quality fisheries data in near real-time to improve the precision of stock assessments; to address concerns about bias in sampling; and to enhance the temporal and spatial resolution of multi-species catch, gear selectivity, and life history data.
23. Applies information technology (IT) and expertise to develop, implement, and maintain a computing environment designed to meet the needs of the users and to comply with NMFS information technology architecture. Coordinates the development and implementation of program products and services; provides information technology transfer to support national and regional IT initiatives; supports the development and implementation of advancements in IT; and supports the works of the National Information Management Board.
24. Educational partnerships, collaborations, and working relationships with academic institutions at pre- and higher education levels; NOAA Education Office; NOAA Fisheries Education Council; and NOAA–wide educational and research experience engagements, including Sea Grant and the NRC postdoctoral program. The purpose of these relationships is to provide: 1) collaborative education and research opportunities between NEFSC scientists and academia; 2) training opportunities for NEFSC staff; 3) career development opportunities for students that will lead to a more diverse NOAA Fisheries workforce using various mechanisms, such as volunteer and paid student internships.

Quality Assurance

The NEFSC does not have a current program review policy, but there have been several reviews as follows:

1. Food Web Dynamics Program Review- 2009
2. Industry Based Cooperative Research Surveys- a series of reviews in 2005-2006
3. Herring Acoustics Survey Program Review- 2001
4. Northern Right Whale Research Program Review- 2006
5. Ship of Opportunity Program (SOOP) Review- 2006
6. Pilot Study Fleet – Electronic Logbook Program Review- 2007

All of these reviews cover narrow areas of the NEFSC's overall program. Such reviews probably improve performance and credibility of the areas reviewed, but the reviews are

insufficient to cover a major portion of the Center's activity on a regular basis and timely manner.

NEFSC sea turtle research was covered by the National Research Council Review of Sea Turtle Science and Assessments (completed in 2010).

The NEFSC indicated that there is a current review of the Social Science Branch, but the material provided indicates that the Branch is involved in a facilitated planning process, not an external program review.

The NEFSC has also conducted several "one off" specialized external peer reviews of scientific products, including:

1. Economic Analysis in Draft Amendment 13 to the Northeast Multispecies Fishery Management Plan (including a Draft Supplemental Environmental Impact Statement and a Preliminary Regulatory Economic Evaluation)- 2004
2. Evaluation of Potential Essential Fish Habitat Designation Methodologies for Use in the Northeast Region of the US- 2005
3. Review of Vessel Calibration Analyses for FSV Henry B Bigelow and R/V Albatross IV- 2009
4. Review of the scientific assessments in support of the New England Groundfish Management Plan conducted by the Department of Commerce Office of the Inspector General- 2009. This review dealt more with procedural matters. We do not consider it a scientific external peer review.

The primary means of reviewing the scientific products used to support fisheries management is the Stock Assessment Review Committee (SARC) process established about 30 years ago, although it has evolved considerably over the years. The current version is overseen by a steering committee comprised of the leaders of the NEFSC, Northeast Regional Office, New England Fishery Management Council (NEFMC), Mid Atlantic Fishery Management Council (MAFMC) and the Atlantic States Marine Fishery Council. Reviews are conducted by external reviewers including several members appointed by the Center for Independent Experts (CIE). Members of the NEFMC or MAFMC Scientific and Statistical Committees (SSCs) are called on to Chair SARCs to smooth the transition of peer reviewed assessments from SARCs to SSC that use the assessments as the basis for recommendations on overfishing levels (OFLs), acceptable biological catch (ABCs) and annual catch limits (ACLs).

SARCs meet twice a year to benchmark a total of about 8-10 assessments per year. Typically assessments are benchmarked about every 3-5 years, with updates conducted between benchmarks. However, there is general recognition that this process is not satisfactory to support the expanded requirements of National Standard 1 guidelines for setting OFLs, ABCs, and ACLs. A re-design process involving the NEFSC, SSCs from the two Councils and the staff of the ASMFC and NERO is underway. Discussions so far have

pointed toward decoupling the benchmarking process from the updating process for assessments, but the details have yet to be formulated, and it is not clear if this approach will solve the apparent problems.

In addition to using the SARC as a stock assessment quality assurance process, the NEFSC has convened three "Groundfish Assessment Review Committees" (GARMs). The first GARM was set up to update all groundfish assessments at once (nearly 20) in order to response to a court ordered schedule for amending the multispecies groundfish management plan. Follow-up GARMs where held at a vehicle for handling a large number of assessments at once. However, the NEFSC indicates that it does not intend to convene GARMs in the future.

Scientific assessments and other products that support requirements of the Marine Mammal Protection Act (MMPA) are reviewed by the Atlantic Scientific Review Group (SRG- essentially the same process for marine mammals as in all the other regions). When we asked if members of the SRG might have a conflict of interest because of they depend on NMFS funding, we were told that they do not receive much funding anymore.

Scientific input to Endangered Species Act decisions is developed through Biological Review Teams (again, similar to other regions). The merits and shortcomings of BRTs, and other aspects of scientific support for ESA are discussed under the description for the SEFSC. The same considerations apply in to the NEFSC and the northeast region.

The NEFSC along with the SEFSC also participates in the Sea Turtle Expert Working Group set up by NMFS Headquarters, although it has not been active in recent years. The Group is also described under the SEFSC section of this report.

In the northeast region, the methodology for identifying Essential Fish Habitat was subjected to a peer review in 2005 as indicated above. Since then, Plan Development Teams and SSC are presumably providing some degree of quality assurance of habitat information, but neither of these groups is well suited to the task. PDTs are not scientific bodies, and SSC are usually lack the time and diversity of expertise to serve as the primary peer review vehicle. They are better suited to interpreting peer reviewed science and translating it into advice, as well as serving as backing up peer review (that is, providing a final check).

During our site visit to the NEFSC, we discussed quality assurance of social and economic impact analyses that support fisheries management and other management decisions. Except for the 2004 peer review of social and economic analyses for Groundfish Management Plan Amendment 14, these products are not subjected to external peer review. This seems to be the case throughout the country. If social and economic impact assessments are an important scientific input to management decisions, as they should be, then they should be subjected to quality assurance processes that are comparable to the processes applied to biological assessments.

Scientific documents of the NEFSC are subject to a Publication Review Policy that requires papers to be reviewed internally and approved by a Division or Laboratory Director, and the Science Center Director. NEFSC scientists had 391 external publications in the period 2005-2009.

Program management

The NEFSC has adopted the following core values based on input from the staff:

RESPECT – HONESTY – INTEGRITY – RESPONSIBILITY –

OPEN COMMUNICATION

and mission objectives of:

RESEARCH AND MONITORING – SCIENTIFIC ADVICE –

EDUCATION AND OUTREACH

It has also agreed to the following vision:

> "Conduct ecosystem-based research and assessments of living marine resources, with a focus on the Northeast Shelf, to promote the recovery and long-term sustainability of these resources, and to generate social and economic opportunities and benefits from their use"

The NEFSC's contribution to the "NMFS 2010 STRATEGIC PLAN FOR MONITORING AND RESEARCH" is viewed as the Center's current Strategic Plan even though the NMFS plan has not yet been adopted. The NEFS contribution identifies 76 research priorities for 2010-2015. Some of the priorities are actionable (that is, they are specific enough so the required action is clear) with measurable outcomes or milestones. However, performance with respect to several general research priorities will be difficult to measure.

These priorities also link to Electronic Annual Operating Plan (eAOP) milestones. Presumably all of the Center's have similar contributions to the NMFS 2010 Strategic Plan, but these were not highlighted during our site visits, probably because some of the contributions had not been completed at the time of the visits.

While the NEFSC's identification of core values, a vision, mission objectives and research priorities, is laudable, it is unclear how these planning vehicles influence program management.

The NEFSC management structure includes a Board of Directors (BoDs) made up of the senior staff. It meets at least annually (our impression is that it doesn't meet more often). There are also senior staff meetings about weekly, in part, to prepare for NMFS weekly video conferences. Budget allocation discussions are made by the Science Center Director and Deputy Director based on program priorities and an analysis of budget shortfalls, and

opportunities conducted, by the OMI. There is also at least one resource review during the year to check budget plans against actual and projected expenditures.

Other observations

1. As in the Southeast, the Center director complained how long it took to make organizational changes. She gave the recent establishment of an Ecosystem Assessment Program as an example.
2. The NEFSC observer program has expanded rapidly in recent years and it now has about 100 contract staff. It was agreed that contract staff is preferable to federal employees for observers. However, there are about 100 additional contract staff and some of these individuals have been long term associations with the Center. Some of them should be federal employees. However, the NEFSC is conservative in federal hiring (this is generally the case with the Centers) because of budget uncertainty. The NEFSC noted, as did some other Centers, that the RO was much more likely to hire federal employees than the Center, even for jobs that were no more permanent, with funds that were no more secure.
3. The NEFSC expressed concern that the Social Science staff was almost totally engaged in non-research NEPA analyses instead of social science research. They felt that some of this work should be done by Council staff or the Regional Office. They seemed unaware that a conscious decision had been made for all the Agency's practicing social scientists (in the field) to be in Centers instead of ROs. The discussion about NEPA analyses vs. research raised the general issue of separation of research and operations. How much separation is appropriate? There are arguments both in favor and against separation.
4. The NEFSC has had a large cooperative research program for over a decade. NMFS also has a large program. This activity is an obvious candidate for a program review. Has the data been used? Are there cheaper ways of getting it? How well has it served its objective of improving working relationships with the industry and the credibility of science? Are there better ways of planning activities, deciding on project funding, monitoring performance, and disseminating results?
5. The Aquaculture and Enhancement Division has benefitted from the NMFS Aquaculture Program after many years of "withering on the vine."
6. The NOAA Chesapeake Bay Program is responsible for considerable research in the Chesapeake Bay, which is within the geographic territory of the NEFSC. Why isn't this scientific activity managed by the NEFSC? Does the CBP have the scientific leadership that is necessary to manage a high quality scientific program?
7. The NEFSC is also involved in the NOAA Ocean Acidification Program. It contributes about three times as much funding (mostly contributions of staff time) as it receives. This is fine if the program is a high priority for the Center (which is seems to be in this case), but what were these resources doing before ocean acidification (what was dropped or were they being under-utilized)?

8. The NEFSC is trying to develop new methods for analysis of digital habitat mapping data working with Larry Myer of the University of New Hampshire. Processing and managing digital habitat data (acoustic, video, etc) is a national problem. Won't it be better to have a single national effort instead of regional efforts? The agency often coordinates regional efforts (National working group on "such and such," but coordination is not the same as an integrated national plan and pooled expertise).
9. We discussed the status of the National Systematic Laboratory at the Smithsonian Institution. This is intended to be a national asset. However, to remain cutting edge it needs to combine traditional taxonomy based on physical examination of specimens with molecular genetics. The necessary investment is not large compared to the NMFS science budget (hundreds of thousands compared to hundreds of millions). Yet the agency does not seem to be able to make a decision on the future of the NSL. Perhaps it is defacto a negative decision, but if so, the decision should be transparent.
10. It was noted that the NERO has increased federal staff a lot in the last decade. This seems to be the case in most regions, while Science Centers federal staffing has been stable or decreasing. In some regions, there is a perception that the ROs are adding staff to perform scientific functions that might be performed in the Centers. This raise the issue of separation of research from operations (is it desirable or undesirable). This separation issue is an important policy call that should be made based on a systematic analysis. Once the decision is made, it should be implemented consistently. Neither seems to be the case.
    In the northeast, the feeling is that most of the growth in the NERO has been non-science, except for the protected species area, where new staff have been hired to perform scientific duties, including some modeling which is not routine or operational.